

I. Plants in relation to man
Man and all other animals are absolutely dependent upon plants for existence.

The first requirements for life of any kind, air and water.

Given air and water plants can make food for themselves in sunlight. (The waters of the ocean teem with minute unattached plants besides the multitudes of seaweeds, great and small.)

Animals must have air, water, and food which has been made by plants.

Plants by means of chlorophyll [chloro = green, phyllon = leaf],

the green substance in their cells, can, in the sunlight, make out of air and water, sugar, starch, and other

organic compounds (carbohydrates) which animals can utilize for food. Everything we eat, except water and salt, is provided for us by plants.

-2-
We depend upon plants for:

1. Food (a) Direct: grains, seeds, fruits, roots, leaves.
(b) Indirect: meat, milk, butter, cheese; fish and mollusks.
2. Clothing (a) Direct: cotton, linen
(b) Indirect: wool, silk, leather, fur
3. Fuel: Wood, peat, lignite, coal, petroleum.
4. Lumber: For buildings wholly or in part; furniture and general comforts of life.
5. Power: Horses, oxen, camels, etc.; steam generated from fuel.
6. Paper and parchment, hence all recorded learning except that engraved on stone or written on wet bricks by dwellers in western Asia in ancient times. *papyrus, brick bank [vellum - skin]*
7. Drugs, oils, dyes, pigments, etc.
8. Sanitation. Living things remain alive relatively but a very short time. Dead and waste organic matter of

^{reduced}
not restored to their chemical elements would cover
the land and fill the sea. Bacteria, the smallest
of plants, restore dead plants and animals to their
original carbon dioxide, water and ash--the ash being
the mineral part taken from the earth.

When I think of this, I am reminded of the fact that
the earth is a vast storehouse of minerals, and that
the life of the world is dependent upon the minerals
which are taken from the earth. The minerals are
taken from the earth, and the life of the world is
dependent upon them. The minerals are taken from
the earth, and the life of the world is dependent
upon them. The minerals are taken from the earth,
and the life of the world is dependent upon them.

Just as the minerals are taken from the earth,
so the life of the world is dependent upon them.
The minerals are taken from the earth, and the
life of the world is dependent upon them. The
minerals are taken from the earth, and the life
of the world is dependent upon them. The minerals
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upon them. The minerals are taken from the earth,
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Very truly yours,
John D. Rockefeller

1. Food (a) Wheat, Corn, Rice, Beans, Potatoes,
(b) Meat, Eggs, Butter, Cheese, Milk, etc.

2. Clothing (a) Cotton, Wool, Silk, Linen,
(b) Leather, Paper, Glass, etc.

3. Shelter (a) Wood, Brick, Stone, etc.,
(b) Coal, Oil, Gas, etc.

4. Transportation (a) Railroads, Steamships,
(b) Automobiles, Bicycles, etc.

5. Amusement (a) Books, Newspapers, Magazines,
(b) Movies, Music, etc.

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the land and fill the sea. Bacteria, the smallest
of plants, restore dead plants and animals to their
original carbon dioxide, water and ash—the ash being
the mineral part taken from the earth.

Distinction between plants and animals.

Plants: Ability to produce their own food from air and water.

(Bacteria and fungi have lost this ability, like animals *they*
obtain food from other plants). Plan of body (when of more
than 1 cell) unlimited, a repetition of similar parts.
Fixed to the earth (in higher plants). No organs of
excretion, matter of no nutritive value stored in
special cells or utilized for protection in various ways
resins, balsams, volatile oils (whence perfumes), waxes,
etc. *Reproduction by buds possible.*

Animals: Inability to produce food.

Plan of body fixed, number of parts definite.

Freely moving (in higher animals)

Waste matter excreted.

*Reproduction by buds impossible except in
few low forms.*

Return.

1929-1930

BRAZIL - 1929-1930

Agnes Chase

Chase, A.

1929-30

HITCHCOCK AND CHASE LIBRARY
Smithsonian Institution

Syntherisma

UNITED STATES NATIONAL MUSEUM

"Panicum stipitatum"

Savanna "Stauke"

National Museum

AS 11:161

I went to Brazil the second time in November 1929. On my previous visit in 1924-25 Miss Rolfs and I ascended Caparaó from the Minas side. Caparaó, the highest mountain of Serro do Mar, is a vast mass with several peaks, the highest of which is Pico de Bandeira, a little less than 10,000 ft. We climbed Pontao Crystal about 200 ft. lower, supposing it to be Pico de Bandeira until the clouds opened for a moment when we were on the summit of Crystal disclosing the higher peak which had been completely hidden. I had found a new *Danthonia* on the shoulder of Caparaó as well as other interesting grasses and I wanted to visit the mountain again, earlier in the season and from the east side. The western side is devastado, the forests cut and burned, but the eastern side is still virgin rain forest.

Mrs. Mexia of the University of California who arrived in Rio shortly after I did joined me in this adventure. Of course, we were told at Alegre, the end of the railroad, when we began bargaining for conveyance ^{to the base of Caparaó} that it was *nao possivel para senhoras*. But I'd heard that before, and so had Mrs. Mexia, who had spent a month alone on the slope of Mt. McKinley in Alaska and had collected in little known parts of Mexico. We finally secured a truck for the next morning and had a few hours left to botanize before dark. I had a glorious find in a steep jungly wood, *Olyra sampaiana*, described by Professor Hitchcock a year or so before from a specimen sent from the Museum at Rio. It was a very peculiar species with milk white narrow panicle, but I found it even more peculiar in having tubers like little potatoes on its roots. The original specimen did not show this. While scrambling up the slope seeking more specimens I saw, about 8 feet away, the largest snake I ever saw outside a zoo. One who has been to Brazil is expected to tell about snakes, so I am glad to have at least one big one. I did not measure it

The anahis

but estimated it at about 15 feet. His head was raised about two feet, facing me. I backed off respectfully.

At Santa Barbara at the foot of Caparaó it took all our powers of persuasion to secure men and mules, the whole settlement taking part in the discussion and telling us it was não possível. It was raining when we started -- it is always raining on Caparaó apparently, especially on the seaward side. The river was high and our pack mule came out with water dripping from the paniers containing plant driers and food. We stayed at the last house that night and proceeded on foot next morning entering the rain forest in a ^{part 2} few hours. We were to spend the night in a cave, but the cave was full of fleas, so Mrs. Mexia and I spent the night in her tiny ^{set up} tent in the forest. The 4 men stayed with the fleas. In the morning we got off early, still raining, the trail, where there was any, a deep sponge or running rivulet. Everything was covered with ferns, from little *filices* to tree ferns. The araponga, the anvil bird, struck ringing blows startlingly like a hammer on an anvil. When we reached the bamboo zone I rejoiced, thinking the worst was over. But this was really the hardest part, tripped continually by the interlacing culms and the trail very steep. About 3:30 we struggled out of the bamboo. It was still steep climbing up the rocky slope but grasses all about rejoiced my heart, though I was wobbly in the knees. There was still a league to go to shelter (a herder's hut on the shoulder of the mountain)--a league is any distance in Brazil. Mrs. Mexia gave out, and we had the men put up the little tent. It was late, so they had to hurry away to reach the shelter before dark. The tent was tied to a boulder at one end and to a gnarled tree

at the other. I had a glorious fire going against a big boulder and had dragged up plenty of brush for firewood, but the wind blew furiously during the night and the sparks looked dangerous so I pulled out the biggest chunks and flung clods of wet grass on the fire leaving it subdued, but hoping it would be alive in the morning. But it wasn't, and I couldn't get another started--everything soaking wet. It rained continually. In the morning we collected quantities. The dominant grass is *Calamagrostis viridiflavescens*, much like our *C. canadensis* in habit. The men were to have come for us in the morning but did not appear till after noon when we were busy putting plants in press inside the tent. They insisted that we come at once to the hut--wouldn't wait for us to put plants in press. But the plants were what we came for, and neither of us was willing to abandon them, so the men had to leave us, declaring we'd lose our lives, to return for us the next morning. It was a terrible night, the water overflowing the trench above the tent and the wind whipping its moorings loose. The men returned about 9 next morning, and we struggled up ^{the mountain} through the rain. Mrs. Mexia said it was like the slope of Mt. McKinley. Half frozen, drenched, muddy and dirty, Dona Maria Magdalena, ^{the herder's wife,} at the hut met us with a basin of hot water and a clean towel and gave us hot milk. ^{Lights out.} We stayed over the next day--and it didn't rain --and began the descent the following morning, passing the night near the cave of fleas, and next evening reaching Santa Barbara. ^{A. chuscale mt top} No botanist had been up the east side before, so I feel my grasses are worth the climb, though I have only one new species, a beautiful *Ichnanthus*.

After a few days about Cabo Frio, ^(east end of state of Rio) I went to Viçosa, where Dr. Rolfs has established an agricultural college for the state of Minas. The plantation of ^{*Hydnocarpus*} ~~*Taractogenes*~~ *kurtzii* (the source of chaulmoogra oil) grown from seed collected by Dr. Rock ^{in Burma} for the Department of Agriculture some years

but continued it at about 10 feet. His head was raised about two feet, looking me. I backed off respectfully. At Santa Barbara at the foot of Capoto it took all our powers of persuasion to secure the men and mules, the whole settlement taking part in the discussion and telling us it was not possible. It was raining when we started -- it is always raining on Capoto especially, especially on the seaward side. The river was high and our pack mules were out with water dripping from the pants containing plant skins and food. We stayed at the last house that night and proceeded on foot next morning, entering the rain forest in a few hours. We were to spend the night in a cave but the cave was full of fleas, so Mrs. Mexia and I spent the night in her tiny tent in the forest. The 4 men stayed with the fleas. In the morning we got off early, still raining, the trail, where there was any a deep sponge or running rivulet. Everything was covered with ferns, from little *Adiantum* to tree ferns. The air was still, when we struck striking blows startlingly like a hammer on an anvil. When we reached the bamboo zone I rejoiced, thinking the worst was over. But this was really the hardest part, tripped continually by the interlocking culms and the trail very steep. About 3:30 we struggled out of the bamboo. It was still steep climbing up the rocky slope but grasses all about rejoiced my heart, though I was wobbly in the knees. There was still a league to go to another (a herder's hut on the shoulder of the mountain)--a league in any direction is Brazil. Mrs. Mexia gave up and we had the men put up the little tent. It was late, so they had to hurry away to reach the station before dark. The tent was tied to a boulder at one end and to a leaning tree

ago, was in flower and some in fruit. He was sending the nuts to the Bureau of Chemistry here. Dr. Rolfs had plantations of ^a native species of *Carpotroche* (an allied genus) which also produces a potent oil. He is very anxious to have some one take up the study of the *Flacourteaceae* there. He has explored the forests of the region and found numerous species as yet unknown.

I made two stops in the high region between Viçosa and Bello Horizonte. Parts of Serra Ouro Branco are covered with brush much like the chaparral of southern California, 6 to 8 ft. tall, horribly tough and interlaced, but the open parts are full of grasses, lovely silvery *Paspalums* and golden *Axonopus*, only found in the highlands. ~~[Lights out]~~

Late in December I reached Diamantina.

[Slide 1. Diamantina from east early morning]

The old town was once important as the center of the diamond mines, but the mines have not been worked for many years. ^{The region} ~~It~~ is sandstone and quartz with schist intrusive, according to Dr. de Silveira, the cartographer of Minas.

[Slide 2. Cordillera San Antonio-- see the ^(buzzards) urubus on the sky line]

I hadn't had such exciting botanizing since my early days in the dunes of northern Indiana. It was the richest grass collecting I ever had. Seven of the silvery *Paspalums* and all manner of rare and beautiful grasses, all over these rough rocks and in the crevices. Species of *Paepalanthus*, *Leiothrix*, *Syngonanthus*, and other *Eriocaulaceae* were abundant in tiny wet basins in the rocks. Martius was at Diamantina and it is the type locality of many species. I collected all but one of the grasses he got here, and Mrs. Mexia got that one when she was there some months later. I collected so many grasses Martius did not get that I think there must be a great

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seasonal change in the flora. One of the striking grasses was a tall
(*maliniodes*)
Panicum with large purple panicle--a bunch grass, only found in clefts
(later Paris)
of rocks. I have never seen this in any herbarium and did not find it
again in Brazil. Martius couldn't have missed it if it had been in
bloom.

I visited various interesting places in Minas and Sao Paulo, Lavras,
Sao Miguel, Poços de Caldas, Casa Branca, where I was glad to see Auricularias
again.

[Slide 3. ^{ran} Auricularia]

A hillside of these trees looks like a piece of tapestry, the regularity
^{so}
appears conventionalized.

Tres Lagoas, near Rio Parana, was the first stop in Matto Grosso.
Except out at Cabo Frio this was the first level ground I'd struck. The
hills of Matto Grosso are mostly low table lands the whole sloping down
gently to Rio Paraguay. I had 2 days at Tres Lagoas, 2 at Campo Grande, half
way across the state and then went south to Dourados on the caminho carrying
the household goods of the Maxwells, missionaries to the Indians there.
From Campo Grande south it is mostly open campo interspersed with cerrado--
brushy woods of low gnarled trees, sometimes almost as dense as chaparral,
sometimes open.

[Slide 4. Cerrado caminho on crutch, Aristida pallens

in right foreground]

This shows the cerrado, as well as the kind of motor roads there
are. The caminho is on a crutch while the wheel is being fixed. These

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frequent stops gave me opportunity to botanize. This is cattle country, but except along the roads the land is not overgrazed. *Aristida pallens*, seen in the right foreground, comes in in overgrazed places.

It took us 4 days to go 312 km. The Brazilians are never oppressed by flight of time as we are. Mr. Maxwell says they have gone directly from the oxcart to the motorcar without the horse and wagon in between, and still have an oxcart psychology. Delay of a day or two is nothing to worry about.

[Slide 5. Oxcart we passed]

We saw many flocks of rhea, called ^{ema} emu in Brazil, mostly hens and little chicks only about 2 feet tall, the largest was a flock of 19, but ^{we saw} occasionally solitary tall dark cocks. We saw a few deer, and after dark an armadillo. Their holes were everywhere. The crested screamer, called *ceriema*, ran before the cars instead of flying away or turning aside. The *gavão*, a large hawk, nearly as large as an osprey, and the *urubu rei*, king vulture, were frequent, the vulture commonly lighting on termite nests and quite fearless. A little owl which flies by day is common. It sat on the ant hills and bobbed at passers by. The *quero-quero* (so named from its cry) was common. It is a beautiful bird allied to the plovers, I judge. I wished I were an ornithologist, the birds were so fascinating. At Lagoinha

[Slide 6. Lagoinha]

I saw a pair of *tu-yu-yu*, very large black and white stork like birds. On the far side of the lake I found *Panicum hemitomon*, the maiden cane of our southern states, not before known beyond our borders. Several grasses have this puzzling distribution, some only known from Texas and again in Paraguay or Argentina. At Dourados there were parrots in millions.

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They flew over at dawn going from the cerrado to the ~~Matto~~ Matto, and in the evening flying back, roosting in the low scattered trees of the cerrado. They are always in twos in the flocks as far as one can see, and always talking. The flight is short, rapid, and appears labored. I first saw toucans here, a rather small species with orange beak. They, too, are nearly always in pairs and nearly as talkative as the parrots.

From my first day in Matto Grosso I kept finding grasses new for Brazil, ~~Paraguay~~ Paraguay and Argentine species. At Dourados I found several.

The Indians here

[Slide 7. Guarany Indians, settlement near Dourados--

Mr. Maxwell the missionary the tall man to right]

belong to the Guarany, a Paraguay tribe. They grow maize and squashes and gather the leaves of Ilex paraguayensis, which is the mate or Paraguay tea. The trees are not cultivated but are common in the region. This is the entire population of the settlement.

[Slide 8. A badly scared little Indian]

[Slide 9. Indian boy with a toucan]

[Slide 10. A girl, who posed more willingly, with the same poor toucan]

Returning to Campo Grande, I went on to Porto Esperança on Rio Paraguay. This is the pontenal, of which ~~Ex~~ President Roosevelt wrote so feelingly--and you could multiply what he says 10-fold and then not overdo the torment of insects. The pontenal is fresh-water marsh which extends many miles eastward from Rio Paraguay. I had two days of good botanizing and exquisite torture. Mosquitoes, midges, that get behind ^{only} my glasses, biting flies of assorted sizes, ticks and other bichos innumerable.

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I went by boat from Porto Esperança to Corumbá. Rio Paraguay is a beautiful stream.

[Slide 11. The west bank of the river]

To the east Paspalum fasciculatum stretched almost to the horizon, with here and there little islets of brush. There were many small floating islands moving down stream. I saw many herons, much like our great blue heron, but gray, without the blue shade, white herons and jacarés or alligators.

Corumba is an old city, and the country about ^{it} is devastado, but I climbed a mountain, Urucum, 16 miles south, one day and crossed into Bolivia the next. All the mosquitoes in Bolivia were there to greet me, and they enjoyed the visit.

Returning to São Paulo I left for Goyaz stopping at Uberlandia in the triangle of Minas, at Viannapolis, the railhead in Goyaz, ^{at} Annapolis, and ^{at} Goyaz capital, ^[quartz rock] and back to Uberlandia by March 28. Here I hired a man with a car to take me to Cuyaba. There are no motor roads. Western Brazil has started in using motor cars and caminhões without stopping to build roads. Much of the old ox-cart roads are a complex of ruts and gullies to 500 feet wide or more, sometimes eroded into deep chasms and arroyos as much as 25 or 30 ft. deep.

[Slide 12. Looking across an eroded gully--this was in Minas]

It is appalling what ox carts do to a country. The oxen have to graze and they destroy all the good plants for a long distance each side of the bad lands made by the cart wheels. Losing the road once we ran into a succession of peninsulas. Jose searched one way, I another, and ~~it~~ took more than 2 hours to get out.

[Slide 13. Typical campo and cerrado in southern Goyaz]

These termite nests are characteristic of the campos every where.

It took 5 days to reach Rio Araguaya, between Goyaz and Matto Grosso, the only tributary of the Amazon I reached. I had one day here and then started across Matto Grosso.

The country is sparsely populated, the dwellings mud huts, shared with the pigs and chickens. I slept in the automobile, to the horror of the people. Jose protested at first, but I think he came to believe that I was protected by some especially efficient santinha, because I remained unharmed after eating oranges first thing in the morning, when he was sure that was certain death; because I went far into the campos ^{the} and matto, where I was warned onças were lying in wait for wandering senhoras, and the tumandú (ant eater) would tear me to pieces with his long ^{claws.} ~~nails.~~ I was sorry to miss the onças and all I saw of an ant eater was the bushy tail as he waddled off through the tall grass.

On the fourth day we found the bridge across Rio Itu was out, and the river was high. Cuyaba was but one day away, but there was no way to get there until the bridge was rebuilt. Returning to Rio São Lourenço we found next morning ^{that} the river had risen. When the car was placed on the ferry and the ferry untied we were carried down stream about 500 ft. before it was driven into the bank at a bend. It took several hours to get the ferry back. Before trying it again Jose wanted me to photograph the populace

[slide 14. All the inhabitants of the village. The tall man next the left end is the superman who saved the ferry from going down river with the car the second time. The man with the boots toward the right is Jose, and behind is the long-suffering car.]

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[Faint, mostly illegible text, likely bleed-through from the reverse side of the page.]

attempt to cross the river
At the next ~~trial~~ there were several men in the water, as well as men and women at the oars. ~~The river~~

[Slide 15. Rio Sao Lourenço]
current
was high, the water very swift and I never saw such mighty human effort in my life--dragging the ferry up stream by ropes about the trees for an hour, then letting it swing out into the current and actually making it strike the other bank. When these men can work so hard and intelligently together it is impossible to understand why they don't build a bridge and roads and decent houses instead of living in such abject squalor.

A day's journey back is Gen. Rondon's fazenda--Rondon is the man who *guided* took Ex-president Roosevelt into the wilds and who nursed him through his dangerous illness, due to an infected leg. Rondon is a Boruro Indian, and his fazenda is worked by ~~these~~ *of his tribe* Indians. At the mission at Rondonopolis nearby I was taken in, dirty and half-famished, by the kindly missionaries. To have hot water for a bath, to sleep stretched out was luxury--and then there were waffles for breakfast. Except for that blessed interval I can't recall a comfortable moment in Matto Grosso, but I had many happy ones--*its* mudholes and insects, but *there were* quantities of grasses, many I'd never seen alive before.

[Cost \$550 for 22 days, the most costly trip I ever made]
It took 6 days more to get back to the railroad. Jose was terribly afraid to drive on santa sexta-feira (Good Friday) but I insisted. He was amazed that I didn't know it was the unluckiest day of the year. It was not that day but Sunday, the last day, that my camera with exposed films was lost.

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[Faint, mostly illegible text on the left page, appearing to be a continuation of a journal or report.]

I saw many deer, ^{and} 2 little yellow foxes on this trip, and a black mutum, much like a cassowary, but about the size of a small turkey. I got a closer view of a pair of tu-yu-yu, and saw several flocks of curie-ca-ca, a black and white ibis. In the stretches of wooded country, the matto, I saw very large woodpeckers, and great blue and red macaws flew in pairs through the openings. They are called arara from their cry. Little green parakeets and larger ones with red markings I saw only near Rio Araguaya.

Naturally I noted grazing conditions. In Pernambuco and Bahia, on my earlier visit, I saw country badly depleted by overgrazing. But in western Brazil, except along the roads, the country has not suffered much. There are thousands of cattle but they are not crowded on the land. Burned areas are taken possession of by molasses grass and jaragua. These are both African grasses but were first described from Brazil, so early were they introduced. They are traveling across country so rapidly it makes a botanist's heart ache to think of how they will drive out the beautiful native species. From an economic standpoint Brazil is singularly blessed by this invasion, for unlike our invaders, injurious bromegrasses and goat grasses, these aggressive grasses are excellent forage.

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CITY OF NEW YORK

Chase, A. [unpubl. mss.]

Botanical Expeditions to Matto Grosso, Brazil,

1788. [Agnes Chase compiled this sketch for

her own reference probably after her 1924-25

or 1929-1930 visit.] [1-4]pages, typescript & halo

" AC crossed Matto Grosso, collected grasses for

about 2 hours across the border into Bolivia.

In Matto Grosso to Curumbá and south (afoot of

course); see AC field books. Also from Rio

Grande south to near Paraguay."

[1] - [18] = my numbering of sequence
as befits the
sense of the
narrative!

M. Steiber
Feb 6/1978

Second visit to Brazil Agnes Chase

I went to Brazil the second time in November 1929. On my previous visit in 1924-25 Miss Rolfe and I ascended Caparaó from the Minas side. Caparaó, the highest mountain of Serro do Mar, is a vast mass with several peaks, the highest of which is Pico de Bandeira, a little less than 10,000 ft. We climbed Pontão Crystal about 200 ft. lower, supposing it to be Pico de Bandeira until the clouds opened for a moment when we were on the summit of Crystal disclosing the higher peak which had been completely hidden. I had found a new *Danthonia* on the shoulder of Caparaó as well as other interesting grasses and I wanted to visit the mountain again, earlier in the season and from the east side. The western side is devastated, the forests cut and burned, but the eastern side is still virgin rain forest.

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At Santa Barbara at the foot of Caparao it took all our powers of persuasion to secure men and mules, the whole settlement taking part in the discussion and telling us it was nao possivel. It was raining when we started -- it is always raining on Caparaó apparently, especially on the seaward side. The river was high and our pack mule came out with water dripping from the paniers containing plant driers and food. We stayed at the last house that night and proceeded on foot next morning entering the rain forest in a few hours. We were to spend the night in a cave but the cave was full of fleas so Mrs. Mexia and I spent the night in her tiny tent ^{set up} in the forest. The 4 men stayed with the fleas. In the morning we got off early, still raining, the trail, where there was any, a deep sponge or running rivulet. Everything was covered with ferns, from little *filices* to tree ferns. The araponga, the anvil bird, struck ringing blows startlingly like a hammer on an anvil. When we reached the bamboo zone I rejoiced thinking the worst was over. But this was really the hardest part, tripped continually by the interlacing culms and the trail very steep. About 3:30 we struggled out of the bamboo. It was still steep climbing up the rocky slope but grasses all about rejoiced my heart, though I was wobbly in the knees. There was still a league to go to shelter (a herder's hut on the shoulder of the mountain)--a league is any distance in Brazil. Mrs. Mexia gave out, and we had the men put up the little tent. It was late so ^{the men} they had to hurry away to reach the shelter before dark. The tent was tied to a boulder at one end and to a gnarled tree

at the other. I had a glorious fire going against a big boulder and had dragged up plenty of brush for firewood, but the wind blew furiously during the night and the sparks looked dangerous so I pulled out the biggest chunks and flung clods of wet grass on the fire leaving it subdued but hoping it would be alive in the morning. But it wasn't and I couldn't get another started--everything soaking wet. It rained continually. In the morning we collected quantities. The dominant grass is *Calamagrostis viridiflavescens*, much like our *C. canadensis* in habit. The men were to have come for us in the morning but did not appear till after noon when we were busy putting plants in press inside the tent. They insisted that we come at once to the hut--wouldn't wait for us to put plants in press. But the plants were what we came for and neither of us was willing to abandon them, so the men had to leave us, declaring we'd lose our lives, to return for us the next morning. It was a terrible night, the water overflowing the trench above the tent and the wind whipping its moorings loose. The men returned about 9 next morning, and we struggled up through the rain. Mrs. Mexia said it was like the slope of Mt. McKinley. Half frozen, drenched, maddy and dirty, Dona Maria Magdalena at the hut met us with a basin of hot water and a clean towel and gave us hot milk. We stayed over the next day--and it didn't rain --and began the descent the following morning, passing the night near the cave of fleas and next evening reaching Santa Barbara. No botanist had been up the east side before so I feel my grasses are worth the climb, though I have only one new species, a beautiful *Ichnanthus*.

After a few days about Cabo Frio I went to Viçosa, where Dr. Rolfs has established an agricultural college for the state of Minas. The plantation of *Taractogenos kurtzii* (the source of chaulmoogra oil) grown from seed collected by Dr. Rock ^{in Burma} for the Department of Agriculture some years

ago, was in flower and some in fruit. He was sending the nuts to the Bureau of Chemistry here. Dr. Rolfs had plantations of native species of *Carpotroche* (an allied genus) which also produce a potent oil. He is very anxious to have some one take up the study of the *Flacourteaceae* there. He has explored the forests of the region and found numerous species as yet unknown.

I made two stops in the high region between Vigosa and Bello Horizonte. Parts of Serra Ouro Branco are covered with brush much like the chaparral of southern California, 6 to 8 ft. tall, horribly tough and interlaced but the open parts are full of grasses, lovely silvery *Paspalums* and golden *Axonopus*, only found in the highlands. [Lights out]

Late in December I reached Diamantina.

[Diamantina from east early morning]

The old town was once important as the center of the diamond mines, but the mines have not been worked for many years. ^{The region} ~~It~~ is sandstone and quartz with schist intrusive according to Dr. de Silveira, the cartographer of Minas.

[Cordillera San Antonio-- see the ^(buzards) urubus on the sky line]

I hadn't had such exciting botanizing since my early days in the dunes of northern Indiana. It was the richest grass collecting I ever had. Seven of the silvery *Paspalums* and all manner of rare and beautiful grasses all over these rough rocks and in the crevices. Species of *Paspalanthus*, *Lelothrix*, *Syngonanthus*, and other *Eriocaulaceae* were abundant in tiny wet basins in the rocks. Martius was at Diamantina and it is the type locality of many species. I collected all but one of the grasses he got here and Mrs. Mexia got that one when she was there some months later. I collected so many grasses Martius did not get that I think there must be a great

seasonal change in the flora. One of the striking grasses was a tall Panicum with large purple panicle--a bunch grass, only found in clefts

A.C. 10346, 10402.

of rocks. I have never seen this in any herbarium and did not find it

again in Brazil. Martius couldn't have missed it, if it had been in bloom. *Panicum molinoides* Trin. *inceptanum*, not at all like *Molinia*

= St. Hilaire C² no 2173, Minas Gerais
" B4450

I visited various interesting places in Minas and São Paulo, Lavras, São Miguel, Pocos de Caldas, Casa Branca, where I was glad to see Auricularias again.

Araucaria
[*Auricularia*]

A hillside of these trees looks like a piece of tapestry the regularity appears ^{so} conventionalized.

Tres Lagoas near Rio Parana, was the first stop in Matto Grosso. Except out at Cabo Frio this was the first level ground I'd struck. The hills of Matto Grosso are mostly low table lands the whole sloping down gently to Rio Paraguay. I had 2 days at Tres Lagoas, 2 at Campo Grande half way across the state, and then went south to Dourados on the caminho carrying the household goods of the Maxwells, missionaries to the Indians there. From Campo Grande south it is mostly open campo interspersed with cerrado--brushy woods of low gnarled trees, sometimes almost as dense as chaparral, sometimes open.

[Cerrado caminho on crutch, *Aristida pallens*
in right foreground]

This shows the cerrado, as well as the kind of motor roads there are. The caminho is on a crutch while the wheel is being fixed. These

frequent stops gave me opportunity to botanize. This is cattle country, but except along the roads the land is not overgrazed. *Aristida pallens*, seen in the right foreground, comes in in overgrazed places.

It took us 4 days to go 312 km. The Brasilians are never oppressed by flight of time as we are. Mr. Maxwell says they have gone directly from the oxcart to the motorear without the horse and wagon in between, and still have an oxcart psychology. Delay of a day or two is nothing to worry about.

[Oxcart we passed]

We saw many flocks of rhea, called emu in Brazil, mostly hens and little chicks only about 2 feet tall, the largest was a flock of 10, ~~but~~ ^{we saw} Occasionally, solitary tall dark cocks. We saw a few deer, and after dark an armadillo. Their holes were everywhere. The crested screamer, called *ceriema*, ran before the cars instead of flying away or turning aside. The *gevao*, a large hawk, nearly as large as an osprey, and the *urubu rei*, king vulture, were frequent, the vulture commonly lighting on termite nests and quite fearless. A little owl which flies by day is common. It sat on the ant hills and bobbed at passers-by. The *quero-quero* (so named from its cry) was common. It is a beautiful bird allied to the plovers, I judge. I wished I were an ornithologist, the birds were so fascinating. At Lagoinha

[Lagoinha]

I saw a pair of *tu-yu-yu*, very large black and white stork-like birds. On the far side of the lake I found *Panicum hemitomon*, the maiden-cane of our southern states, not before known beyond our borders. Several grasses have this puzzling distribution, some only known from Texas and again in Paraguay or Argentina. At Dourados there were parrots in millions.

They flew over at dawn going from the cerrado to the ~~Mat~~ta and in the evening flying back, roosting in the low scattered trees of the cerrado. They are always in twos in the flocks as far as one can see, and always talking. The flight is short, rapid, and appears labored. I first saw toucans here, a rather small species with orange beak. They, too, are nearly always in pairs and nearly as talkative as the parrots.

From my first day in Matto Grosso I kept finding grasses new for Brazil, Paraguay and Argentine species. At Dourados I found several.

The Indians here

[Guarani Indians, settlement near Dourados--

Mr. Maxwell the missionary the tall man to right] belong to the Guarani, a Paraguay tribe. They grow maize and squashes and gather the leaves of *Ilex paraguayensis*, which is the mate or Paraguay *tea*. The trees are not cultivated but are common in the region. This is the entire population of the settlement.

[A badly scared little Indian]

[Indian boy with a toucan]

[A girl, who posed more willingly, with the same poor toucan]

Returning to Campo Grande, I went on to Porto Esperança on Rio Paraguay. This is the pontenal, of which Ex-president Roosevelt wrote so feelingly--and you could multiply what he says 10-fold and then not overdo the torment of insects. The pontenal is fresh-water marsh which extends many miles eastward from Rio Paraguay. I had two days of good botanizing and exquisite torture. Mosquitoes, midges, that get behind ^{over} my glasses, biting flies of assorted sizes, ticks and other bichos innumerable.

I went by boat from Porto Esperança to Corumba. Rio Paraguay is a beautiful stream.

[The west bank of the river]

To the east *Paspalum fasciculatum* stretched almost to the horizon, with here and there little islets of brush. There were many small floating islands moving down stream. I saw many herons, much like our great blue heron, but gray without the blue shade, white herons and jacares or alligators.

Corumba is an old city and the country about ^{it} is devastado, but I climbed a mountain, Urucum, 16 miles south one day and crossed into Bolivia the next. All the mosquitoes in Bolivia were there to greet me and they enjoyed the visit. *added 2 genera of grasses to known flora of Bolivia.*

Returning to São Paulo I left for Goyaz stopping at Uberlandia in the triangle of Minas, at Viannapolis, the railhead in Goyaz, and Annapolis, Goyaz capital, and back to Uberlandia by March 28. Here I hired a man with a car to take me to Cuyaba. There are no motor roads. Western Brazil has started in using motor cars and caminhaos without stopping to build roads. Much of the old ox-cart roads are a complex of ruts and gullies to 500 feet wide or more, sometimes eroded into deep chasms and arroyos as much as 25 or 30 ft. deep.

[Slide 12. Looking across an eroded gully--this was in Minas]

It is appalling what oxcarts do to a country. The oxen have to graze and they destroy all the good plants for a long distance each side of the bad lands made by the cart wheels. Losing the road once we ran into a succession of peninsulas. José searched one way, I another, and ~~at~~ took more than 2 hours to get out.

[Slide 13. Typical campo and cerrado in southern Goyaz]

*replanted grass country. Dried my plants and Fawsharts
dried on roof of the hospital - English family, Fawsharts
their little boy, changed the
name the hospital, very kind to me. Their little boy, changed the
name Christopher Robin.*

These termite nests are characteristic of the campos every where.

It took 5 days to reach Rio Araguaya, between Goyaz and Matto Grosso, the only tributary of the Amazon I reached. I had one day here and then started across Matto Grosso.

The country is sparsely populated, the dwellings mud huts, shared with the pigs and chickens. I slept in the automobile to the horror of the people. José protested at first, but I think he came to believe that I was protected by some especially efficient santinha, because I remained unharmed after eating oranges first thing in the morning, when he was sure that was certain death; because I went far into the campos and ^{the} Matto where I was warned onças were lying in wait for wandering senhoras and the tumandú (ant eater) would tear me to pieces with his long ^{claws} ~~nails~~. I was sorry to miss the onças and all I saw of an ant eater was the bushy tail as he waddled off through the tall grass.

On the fourth day we found the bridge across Rio Ita was out and the river was high. Cuyaba was but one day away but there was no way to get there until the bridge was rebuilt. Returning to Rio São Lourenço we found next morning the river had risen. When the car was placed on the ferry and the ferry untied we were carried down stream about 500 ft. before it was driven into the bank at a bend. It took several hours to get the ferry back. Before trying it again José wanted me to photograph the populace

[slide 14. All the inhabitants of the village. The tall man next the left end is the superman who saved the ferry from going down river with the car the second time. The man with the boats toward the right is José, and behind is the long-suffering car.]

attempt to cross the river
At the next ~~trial~~ there were several men in the water as well as men and women at the oars. The river

[Slide 15. Rio Sao Lourenço]

was high, the water very swift and I never saw such mighty human effort in my life--dragging the ferry up stream by ropes about the trees for an hour, then letting it swing out into the current and actually making it strike the other bank. When these men can work so hard and intelligently together it is impossible to understand why they don't build a bridge and roads and decent houses instead of living in such abject squalor.

A day's journey back is Gen. Rondon's fazenda--Rondon is the man who took Ex-president Roosevelt into the wilds and who nursed him through his dangerous illness, due to an infected leg. Rondon is a Boruro Indian and his fazenda is worked by these Indians. At the mission at Londonopolis nearby I was taken in, dirty and half-famished, by the kindly missionaries. To have hot water for a bath, to sleep stretched out was luxury--and then there were waffles for breakfast. Except for that blessed interval I can't recall a comfortable moment in Matto Grosso but I had many happy ones--mudholes and insects, but quantities of grasses, many I'd never seen alive before.

[Cost \$550 for 22 days, the most costly trip I ever made]

It took 6 days more to get back to the railroad. José was terribly afraid to drive on santa sexta-feira (Good Friday) but I insisted. He was amazed that I didn't know it was the unluckiest day of the year. It was not that day but Sunday, the last day, that my camera with exposed films was lost.

I saw many deer, ^{and} 2 little yellow foxes on this trip, and a black mutum, much like a cassowary, but about the size of a small turkey. I got a closer view of a pair of tu yu yu, and saw several flocks of curie-ca-ca, a black and white ibis. In the stretches of wooded country, the matto, I saw very large woodpeckers, and great blue and red macaws flew in pairs through the openings. They are called arara from their cry. Little green parakeets and larger ones with red markings I saw only near Rio Araguaya.

Naturally I noted grazing conditions. In Pernambuco and Bahia on my earlier visit I saw country badly depleted by overgrazing. But in western Brazil, except along the roads, the country has not suffered much. There are thousands of cattle but they are not crowded on the land. Burned areas are taken possession of by molasses grass and jaragua. These are both African grasses but were first described from Brazil, so early were they introduced. They are traveling across country so rapidly it makes a botanist's heart ache to think of how they will drive out the beautiful native species. From an economic standpoint Brazil is singularly blessed by this invasion, for unlike our invaders, injurious bromegrasses and goat grasses, these aggressive grasses are excellent forage.

good for
introduction

Grass

used
common here

By Agnes Chase, Senior Botanist

Man like other animals is wholly dependent for his living on the plant kingdom, and of all plants the grasses are the most important to him. All our breadstuffs, wheat, corn, oats, rye, barley, and rice, as well as sugarcane, are grasses. Bamboos are grasses, and so are the Kentucky bluegrass and creeping bent of our lawns, the timothy and redtop of our meadows. If such different looking plants as bamboo, corn, and timothy are all grasses, what is it that characterizes a grass? It is the structure of the plant. All grasses have stems with solid joints and 2-ranked leaves, one at each joint, the leaves consisting of two parts, the sheath, fitting around the stem like a split tube, and the blade, commonly long and narrow. No other plant family has just this structure. Clover and alfalfa, built on a very different plan, are not grasses.

Grasses have a wider range than any other plant family, occupying all parts of the earth and exceeding any other in the number of individuals. They reach the limits of vegetation in the polar regions and on mountain tops, endure both cold and torrid desert conditions, form the main part of the vegetation of vast prairies, plains, savannas, and steppes, of both hemispheres, and occupy great stretches of marsh and tide flats. Bamboos, the largest of grasses, form extensive forests and dense jungles.

Eastman

Grasses, like sunlight, air, and water, are taken for granted.

For more than a generation scientists in the Department of Agriculture had been preaching to deaf ears the dangers of overgrazing. For thousands of years our Great Plains maintained countless herds of bison, which provided meat and clothing for ~~A~~^a hundred generations of Indians. Then came the white man and in two generations the plains which had stood knee deep in grass were reduced to semidesert, because overgrazing had destroyed the thick mat of sod that held the rain and melting snows and prevented erosion. With expanding population semiarid land was plowed that should have been left as grazing land. Dust storms and floods, the rapid run-off from denuded land, have taught us a lesson and erosion control work is now going ahead in earnest. In the work of revegetation, grasses are of first importance for these areas. We have many excellent native soil binders, grasses with stout rootstocks that form a network below the surface. Grasses from Asia and elsewhere are being tried also. Two from Siberia are making rapid progress in the Dakotas.

Not only do grasses hold the soil, some of them built up the soil in the first place. One of the cord grasses (Spartina) has filled up miles of marshland in the Middle West, converting it into rich black prairie. Two others, one on the Atlantic Coast and the other on the Pacific, have reclaimed many miles of salt marsh. Much of rich tidewater Virginia was built up through the ages by cordgrass.

Dr. D. S. S. S. S.

*Dr. Beckwith
Shanklin*

-3-

Man's first attempts to control his fate, to provide for future need instead of remaining the victim of droughts or other untoward circumstances, must have been on grasslands where the young calves, lambs, and kids he caught and tamed could find forage. It was on grasslands, too, that primitive man, ~~after he had reached the food-producing~~ ~~as distinguished from the food-gathering stage,~~ developed most rapidly. The earliest known records of human culture are found in the Nile Valley and in southwestern Asia, open country of scanty rainfall.

It is not known when man began to cultivate the grains, for at the dawn of history wheat and barley were in cultivation in Egypt and to the east of the Mediterranean. Rice has been cultivated in eastern Asia since prehistoric time. Rye and oats came into cultivation later. Sorghum, the millets, and other grass seeds (or grain) form the bread-stuffs of many peoples in Asia and Africa.

In the western hemisphere ^{*Indian*} Amerindian culture developed ^{*about*} about maize or Indian corn. The Inca, Maya, Aztec, and Pueblo civilizations were based upon it, and it was cultivated by the North American Indians over much of what is now the United States. The hungry Pilgrim Fathers, we are told, found a buried hoard of Indian corn during their first terrible winter in the New World and thankfully appropriated it. The Indians taught the Pilgrims how to plant maize, or corn, as it was called by the English settlers.

Grasses are the greatest single source of wealth in the world, for they furnish not only the breadstuffs but are the principal constituent of pastures, wherefore meat and dairy products, leather, and wool, are secondary products of grass.

Besides food, grasses furnish endless other necessities. More than a hundred commercial products are now made from maize (or corn) from alcohol to wall board, from the gum on your postage stamp to your "rubber" hot-water bottle, ~~for~~ for so called "red rubber" erasers, rings for fruit jars, sponges, bathmats, ~~are~~ are not rubber but a by product of corn. The amber head of your umbrella is very likely derived from corn stalks, and now furfural, made also from cornstalks is being used in the construction of roads, making the cement more durable. It would take ~~an hour~~ ^{pages} just to name the uses of grasses.

So large and important a family as the grasses necessarily requires critical study. ^{From the time of} ~~Ever since~~ Dr. George Vasey in the 80's of the last

^{US!} century, the Department of Agriculture ~~has~~ maintained specialists on grasses. The grass collection of the United States National Herbarium

is the largest and by far the most nearly complete collection of grasses in the world. Students have come from all over ^{from south American countries,} this country, and even from ^{and the Philippines} China, ⁱⁿ to study in this herbarium and ⁱⁿ the library connected with it. A herbarium is to the study of plants what a dictionary is to literature; it enables us to use words in the same sense, to communicate knowledge with precision.

used on
mostly

Good

13

5-

refer to Agnes Carter

~~This past summer~~, visiting the British Museum in London, I saw in the Egyptian hall, exhibits of the contents of ancient graves. In one was a little earthen bowl of barley. One of the sculptures from a tomb showed a sow and five little pigs in a field of sorghum.

At the dawn of history the beginning of cultivation of grain was so far in the past that it had become a myth. In Egypt wheat was held to be the gift of Isis, in Greece of Ceres--our breakfast cereals commemorate the Greek myth to this day.

In China and the East Indies the cultivation of rice became the basis of civilization, and to the south of Egypt the cultivation of sorghum.

In America a high stage of civilization was attained by the Indians who cultivated maize or Indian corn. As in the case of the Old World grains the beginning of its cultivation was veiled in myth. Maize was a gift of the gods. ^{(“} ~~///~~ In Hiawatha we have all read of one of the myths. When the white man arrived maize was cultivated from Central America south to Peru and north to Quebec. The Inca, Maya, Aztec and Pueblo civilizations were based on it and it was cultivated by the North American Indians over much of what is now the United States. The hungry Pilgrim fathers, we are told, found a buried hoard of Indian corn during their first terrible winter and ~~they~~ thankfully stole it.

appropriated

14
~~81~~

Maize has never been found growing wild and its origin is unknown. No wild species is at all like it, and it is wholly unadapted to maintaining itself without cultivation. Maize is the most highly specialized grass in the world, and it was the American Indian, who, by artificial selection through thousands of years before the coming of the white man, produced this marvel of plant breeding.

All the grains, to which man owes his civilization, are annual grasses, that is the plant bears one crop of seed and dies. An annual that failed to bear good seed would become extinct. Primitive man, or woman, rather, gathering seeds of grasses to add to the food supply, naturally took those of annuals, which were larger and more abundant. Annuals, being short-lived, produce seed within a few months after planting, while perennials seldom bear seed the first year. Naturally, then, it was annuals that were chosen for cultivation.

^{cane,} Sugar ~~cane~~, ^{a large perennial grass,} also a grass, has been bred for artificial sterility, for the sweet juice in the stem from which sugar is made would be used by the plant itself if it produced a good crop of seed.

~~Besides the food we obtain directly from grasses we get our meat and dairy products from grasses indirectly in that they are the principal feed of domestic animals.~~

~~Grasses supply an infinite variety of our daily needs besides food-- brooms, straw hats, paper pulp, perfumes, citronella flydope, and all manner of articles made of bamboo. Maize, besides giving us cornmeal, cornstarch, hominy, corn syrup, mazola and other foods, yields a vast number of products. The gum on postage stamps, the red rubber erasers, hot water bottles, ^{rubber} rings for ~~rubber~~ jars, rubber~~

rubber
sponges, come from corn. Your umbrella handle and fountain pen may be made from corn cobs. And of course corn and rye are sources of alcohol.

Land Building
Besides all this, grasses have built up arable land from freshwater and tidal marshes. On mud flats and tidal estuaries such as those in the Gulf of St. Lawrence, Chesapeake Bay, and San Francisco Bay, different species of *Spartina* are holding the coast and building up dry land. These grasses thrive in the soft mud submerged at high tide, their stout rhizomes forming a firm network ever pushing seaward.

Wash
In the English Channel and on the coast of Holland miles of land are thus being formed. In Holland the plants are set out in rows at right angles to the shore in the mudflats outside the dykes. The shallow

Zuyder Zee has long been filling up by this means and will be ready for settlement before many years.

"Crops are now harvested and 2 villages have been built where 5 years ago there was only sea."
To many people grass is anything that cattle will graze or that

will make a lawn, and they think clovers and alfalfa are grass--but they are not. The true grasses form a distinct and well marked family, highly specialized relatives of the lily. They have been so successful in the struggle for existence that they are one of the three largest plant families and exceed all others in the number of individuals. Grasses are found from seashore to the limits of eternal snow, from desert to tropical marshes and forests. Grasses as a whole are sun-worshippers. They love open country. Those that grow in dense forests, keep to the trails or occupy open spots where trees have fallen, or they climb till they reach the sunlight, then fall like lacy green curtains from the tree tops. [Arthrostyidium]

The beauty of grasses is something most people are blind to (Show specimens)

The fascination of grasses is not wholly due to their great usefulness. The student of grasses loves them for their own sake. In the Grass Herbarium at present inadequately housed in the old Smithsonian Building, there are some 200,000⁺ specimens of grasses, by far the greatest collection of grasses in the world. [Show Manual]

We are striving to have all ^{grasses, especially especially} American grasses well represented, not only those of the United States. Professor Hitchcock ~~has~~ collected grasses from Alaska to Chile, Labrador to the West Indies, Panama and British Guiana, Hawaii, Philippines, Japan, China, and Africa. I have collected in Puerto Rico ^{and Venezuela} and Brazil. [Map] To most people Brazil means either the Amazon or Rio de Janeiro. But ^{it} there is a vast territory, comprising about half of South America, and larger than the U. S., excluding Alaska.

Rio
Pernambuco

Paulo Affonso

Bahia

Minas- high grasslands like eastern Montana.

Brazil is one of the oldest land masses in the world, much too old for fossils or coal or oil. All the eastern uplands are granite, ^{or granite} schist. The country dips to the west and northwest till along the Paraguay and upper Amazon it is only a hundred feet or so above sea level or even less.

Itatiaia

Araucaria

Ceiba trees, quaresma (Tibouchina)

Serra de Cipo

Serra de Gramma

Caparaó Minas slide

Second trip 1929-30

Caparaó from Espirito Santo side

Cabo Frio

Vicosa

Belle Horizonte

Diamantina & elsewhere in Minas

Western Minas

Matto Grosso south to near Paraguay, west to Bolivia

Western Minas, Goyaz

Matto Grosso

People

use of quinine

Wheat bread

few Cal. goats

Brazilian cardinal

schia related to our robin

parrots

arara - related to par.

araponga

Ceribunda } tall birds

sun } red & black

Good looking man
man in uniform (parish)
boy

business
of arts
insects

WYCKOFF AND CHASE LIBRARY
Smithsonian Institution

Agave chalcensis
24-2
24-30

First visit to Brazil

With the financial assistance of the United States Department of Agriculture, the New York Botanical Garden, the Missouri Botanical Garden, the Gray Herbarium, and the Field Museum of Natural History, I was able last year to realize a long-cherished dream of a botanical trip to Brazil. That country is larger than the United States, excluding Alaska, hence a very small part of it could be worked in a single season. I was especially desirous of visiting the parts of Minas Geraes traversed by Martius in 1818, and by the few botanists that visited the interior in the early part of the last century. Many species of grasses of Nees and of Trinius were based on material collected on those journeys. Very little, at least of grasses, has been collected in that region since. Besides Minas Geraes I wished to visit Pernambuco and Bahia.

I landed in Rio de Janeiro November 1 last and left 3 days later for Pernambuco in order to reach that region before the dry season was much advanced. The strip of sandy coast to north and south and the red clay hills and swamps inland from the city afforded good botanizing.

I made a 4-day trip to Bello Jardim in the sertão, as the arid region of the interior is called. The country is hilly (625 meters altitude) and covered with low scrub. The shrubs, now at the beginning of the dry season, were mostly leafless, but many were in bloom. The country is so closely grazed by donkeys, sheep, and goats that I found

grasses only in the shelter of thorny shrubs or of cactus.

Garanhuns, the end of the railroad to the south west of Pernambuco, is also in the sertão, but afforded much better botanizing. From here, together with two women missionaries, I went to Paulo Affonso Falls in Rio São Francisco. I had been told that no botanist had visited the falls and I looked forward to a fine harvest, but the great muddy river flows through a desert. The spray from the mighty falls does not water the walls of the gorge, which are hot bare rock. There were plenty of cacti and some beautiful flowering shrubs and vines but very few grasses.

Returning to Garanhuns I went to Macieó, thence by steamer to Bahia.

The peninsula of Bahia is hilly and forested. The trail borders and banks were rich in grasses. I went to Joazeiro, two days journey by rail. Martius, ~~descending~~ ^{crossed} Rio São Francisco, ~~left the river at~~ ^{at this place} ~~this place and went overland to Bahia.~~ Donkeys, horses, cattle, sheep and goats have changed the character of the country from what it was in Martius' day. Two places north of Bahia seen from the train, Alagoinhas and Parafuso, looked promising. I spent a day in each and obtained fine collections at both. Another profitable trip was across the bay to Cachoeira and Feira Santa Anna.

I reached Rio de Janeiro the second time early in January, and at once began on classic Corcovado. The grass flora is very rich in the mountains about Rio. Through the kindness of Dr. Campos Porto of the Jardim Botânico, Dona Maria Bandeira, who is working at the Jardim Botânico on the mosses of Brazil, and I had the opportunity to visit Itatiaia and climb its peak, Agulhas Negras, the highest point in Brazil.

Above timber line grasses were abundant. The cuts along the trail below also yielded a fine harvest.

Early in February, toward the end of the rainy season, I went to Minas Geraes. Here I got into the "campos," open or brushy grasslands covering the high hills. I visited Juiz de F6ra, Barbacena, Lavras, Oliveira, Bello Horizonte, Lagoa Santa, and Serra do Cip6, Ouro Preto, and Itacolumi^{mi}, in the campo country and Viçosa, Serra da Gramma and Serra do Capara6 in the zona da matta, or wooded country. The campo country was exceedingly rich in grasses. Many supposedly rare species I found to be common.

I took with me a compiled list of grasses known from Brazil. There are some 1100 species in this list. I found about 500 species, some being hitherto unknown from Brazil and some, I think, undescribed.

When six months in one small corner of Brazil yields so large a number it makes one eager to cover more of the country.

Brought back about 15000 specimens.

In connection with my work I've made 2 visits of 8 months each to Brazil. To people in general Brazil means Rio de Janeiro or the Amazon and its jungles. But there's a great deal more to Brazil than that. It is larger than the U. S., excluding Alaska. In the Pan American Building is a large relief map of Latin America. This gives a ~~vivid representation of Brazil.~~ Nearly half the country is highland, all this eastern and southern part, and geologists say it is one of the oldest land masses on the globe. Two peaks of about the same height, just under 10000 ft., Itatiaia and Pico de Bandeira, in the mountain chain bordering the coast are the highest points in Brazil. The rest of the upland lies between 1000 and 5000 ft., very broken, a mass of rugged mountains in the east, gradually changing to rounded hills ^{or tablelands} toward the west. Half way across Matto Grosso it becomes flat and lower until along Rio Paraguay it is not much above sea level.

It is a land of palms and humming birds. Only in places in Matto Grosso is one out of sight of palms. A favorite poem of the Brazilians begins: [17]

Minha terra tem palmeiras
Onde cant' o sabiá

Mine is a land of palm trees, where the sabiá sings. The sabia is related to our robin. There are several species, some with songs startlingly like our robins, but the sabia, beloved of Brazilians, has a ~~very lovely~~ song, more like that of our hermit thrush.

The coast ranges are mostly wooded, called the matta, but westward the campos, open grassland or savannas of grass and scattered shrubs, begin, and stretch to Rio

Paraguay. ~~The campos were my objective.~~

~~When Mrs. Owen invited me to be your guest today she asked what I would speak on. I told her I could talk on grasses all day and all night. She looked a bit dubious. I'm not going to, but I can't resist talking grasses a minute or two. It is almost literally true that all flesh is grass in that our breadstuffs are the grains of grasses. Wheat, corn or maize, barley, rye, oats, rice, are all grasses, as well as sugar cane, and so are most of the forage plants our cattle graze upon. So when we eat beef, or mutton, milk, cheese or butter, we consume grasses at second hand. The grass family is so important to man and the United States is so blessed with vast grasslands, prairies, plains and savannas, that for some 50 years grasses have received special study in the Department of Agriculture. The Grass Herbarium (Prof. Hitchcock, chief) is today the largest and most complete collection of grasses in the world. Well, what good is it? What is its practical use? The Herbarium and work carried on there is to applied botany-which is plant industry-- what a dictionary is to literature. It enables people to understand each other by using the same name for a certain thing. A farmer in Maine once told me he thought it was funny that an agricultural bulletin said that June grass was good pasture; he thought it was worthless. I suspected the trouble and asked him to show me his June grass. It was a little relative of the oat, of no value; but the June grass recommended in the bulletin was Poa pratensis, Kentucky blue grass, commonly called June grass in the middle west. That is the trouble with common names-- they lead to confusion. Hence for accuracy the Latin name, the same throughout the world for a particular~~

[2]

realized - they must have given the wrong name

species, must be used. But the Latin names must be used correctly. Two or three years ago the office of Forage Seed and Plant Introd. sent a memorandum to the Grass Herbarium asking where seed of *Paspalum virgatum* could be secured. An experiment station in Australia wanted to try it. This particular grass is avoided by stock for some reason --I've seen great clumps of it in Porto Rico and Brazil standing untouched where cattle were grazing other grasses all about it. So I began a search --books, agricultural journals, bulletins, indexes, and the herbarium, and finally found out that an excellent forage grass, *Paspalum Urvillei*, introduced from South America into our Gulf States, had been introduced into English colonies in Africa under the name *Paspalum virgatum*, and the Australian obviously got the name from some British publication. This information was sent to F. S. P. I. If the matter had not been looked up the U. S. Department of Agriculture would have gone to the trouble of securing seed of a worthless grass and the Australian Experiment station would have wasted time and effort raising a plot of it. This gives only a hint--our work has to do with the identity of grasses all over the world, and we identify some 10 to 12 thousand specimens every year. To know the grasses one must study them not only in the herbarium and from books but where they grow. For this reason Professor Hitchcock has explored in the last 30 years practically all the United States, Alaska, Mexico, Central America and the Central Andes, Hawaiian Islands, Philippines, Japan, eastern and southern China, and south and east Africa. I have been over a good part of the United States; made one trip to Porto Rico and two to Brazil. [3]

In connection with my work I have made 2 visits of 8 months each to Brazil.

Now we are back to Brazil. The flora of Brazil happens to have *has* especial importance because the earliest extensive collection of plants in the Western

Hemisphere was made in that country. And a woman (though I surmise a very unwilling one) was at the bottom of it. When Francis I of Austria sent his daughter Leopoldina to Brazil to marry the crown prince (the man later known as the Liberator) he sent an honorary escort of scientists with her. This Francis was a grandson of Maria Theresa and he was the grandfather of Maximilian the short-lived "emperor" of Mexico and of the late Francis Joseph of Austria. Francis I was a patron of science on the side. Opportunism in politics seems to have been his principal occupation. In 1810 he gave his daughter Marie Louise to Napoleon, then at the height of his power; and in 1817, Napoleon being down and out, he gave his younger daughter Leopoldina to the royal family that had fled before Napoleon from Portugal to Brazil. Poor Leopoldina seems to have been as reluctant a bride as was Marie Louise. She delayed her departure so long that some of the eager scientists of the honorary escort set sail without her. Martius, the Bavarian leader of the scientific expedition and some others set out for Brazil and arrived at Rio de Janeiro in July 1817. Leopoldina did not arrive until November. She lived but eight years longer. Dom Pedro, the last emperor of Brazil, was her son. [4]

1924 You have all

I reached Rio the first of November. I had seen pictures and read descriptions of Rio harbor but the reality was almost overwhelming. As we entered the bay with peaks in all directions I had the sensation of sailing into the tops of a mountain chain on a flood. Sugar Loaf rises a sheer 1250 feet from the water. My first objective was Pernambuco-- ships from U. S. did not stop there so I had to go to Rio and then up on a Dutch coffee ship.

Question
Rio
1964

28

1961. The following day I botanized on Corcovado, where Martins and Raddi botanized more than a hundred years before. Though a cog road runs to near the summit the mountain sides have not been devastated, dense forest and climbing bamboos still flourish. About half way up is this old stone aqueduct still in use. Martius tells of following this beautiful trail. [5]

1967. There is a famous botanical garden at the foot of Corcovado- this peak in the background.

1968 another view in garden

1867. A few days later I took a Dutch coffee ship to Pernambuco. This is a mangrove swamp. Mangroves are to the coasts of the Tropics what Spartina is to the coasts of temperate regions. The trunks and branches send out arching stilt roots, ever advancing as the mud flat is built up by the silt and sand carried in by the tide and dropped because the mangroves retard the force of the waves.

1761. The interior of Pernambuco is subarid. This is typical sertão, as it is called, — ~~The~~ low trees and shrubs with light gray bark and small leaves which drop in the dry season.

~~I~~ — I had heard much of the Paulo Affonso falls in Rio São Francisco, higher than Niagara and of much great volume. No botanist had visited the region. so I

[6]

-6-

One of the greatest water falls of the world is in Rio São Francisco. No botanist had been there and though they are difficult and costly to reach I felt I must go. At Garanhunas in the hills to the southwest I hired an ancient Ford and a youth to run it and with 2 women missionaries as guests, rode all day through the sertao over a newly cut road that would make an American motorist faint. ~~about 100 kilometers distant.~~

1776. The region was most interesting, cashew trees in bloom, humming with bees, desert shrubs in gorgeous bloom, some leafless, some with brilliant glossy foliage.

Some of the views along the way:

#3.

1775. Flamboyant trees, like great red umbrellas.

typical Brazilian town

1778. Zebu bullock. The zebu, imported from India thrives in Brazil, and is

immune to tick fever. The original longhorned Brazilian cattle are being replaced
by crosses with Zebu.

[7]

Slide
~~It was not late spring, the end of the rainy season and the small trees and shrubs were in gorgeous bloom.~~ We reached Pedra, about 25 km. from the falls, about dark. The older missionary stayed therefor the night, while the younger one and I went on, planning to hang our hammocks to the trees and have a shower bath in the spray somewhere in the dark. A turbine station had recently been built at the falls, transmitting power to a thread factory at Pedra. As we sped along, the headlights showing cactus and the pale gray stems of leafless shrubs, I waited breathlessly for the plunge into the forest. But we reached the end of the road, heard the roar of mighty waters and no sign of a forest, no trees whereon to hang our hammocks; so we hung them in an empty house. How could there be such mighty falls ~~and such spray~~ without verdure? As I lay in my hammock too excited to sleep and listened to the roar I felt sure morning would reveal dripping cliffs with climbing bamboos and rare grasses. But at dawn I left my hammock to view the greatest fall and the most lifeless desert I have ever seen. *water*

The land is flat with abrupt red hills. In wet meadows and stream borders I found great grasses higher than my head-- a joy to find but terrible things to dig up, and interesting water grasses. I went a day's journey into the sertao the arid interior, something like parts of New Mexico, to the northwest.

The hospederia (hotel) at Bello Jardim was my introduction to the typical house of the interior, the walls of mud bricks, built into a sort of lattice of stout uprights and slender horizontal sticks, the floors of uneven large bricks, and the roof of trough-shaped tile. There is no ceiling in this type of house, the tile roof while shedding the rain, admits the air. There are no windows and at night the doors are bolted shut. The partitions between the rooms are about 7 or 8 feet high, so that the cool air, descending through the roof at night circulates freely. Mosquitoes were plentiful, but I always carried a net with me. This with my rubber poncho spread rubber side down, over the sheetless bed assured sleep. I thought that place was primitive but I hadn't then encountered mud huts with dirt floors and no such thing as a chair or bedstead. [8]

I had letters to missionaries and received much help and information from them. The consuls, so far as my experience goes, know only the coast-- nothing about the interior. But the missionaries travel everywhere and like botanists do it on as little money as possible, and here and elsewhere they gave me information that saved me much time and trouble.

It was sunset when we reached Pedra and the last 25 kilometers were made in the dark, ^A as we sped along, the head lights showing cactus and pale gray stems of leafless shrubs, I waiting^{ed} breathlessly for the plunge into tropical forest. But the desert reaches to the brink of the falls. At early dawn I left my hammock to view the greatest waterfall and the most lifeless desert I have ever seen.

Some views of the falls, which are some 250 feet high (Niagara is about 160 feet).

Paulo Affonso is not one straight fall but is much broken:

1789

1790. Paulo Affonso falls (falls no.2).

1792. Paulo Affonso falls, facing island.

1793. Paulo Affonso falls, facing island.

[9]

1801. Paulo Affonso falls from turbine station.
1803. Paulo Affonso falls from turbine station.
1805. Paulo Affonso falls from turbine station.
1807. Paulo Affonso falls; dry section of wall of inaccess^{cc}ible island- note cactus.
1812. Paulo Affonso falls. Verdure zone on inaccessible island.
1821. Paulo Affonso falls, little falls.
1826. Paulo Affonso falls. Agua de Venta falls, from east wall. [10]

1794. Upstream -- this is what there was by way of vegetation. I was greatly disappointed but I found when I came to study my collections, ^{later} that among the few grasses were some rare, one the first collection since the original, and one new species.

1829. *Returning to the coast and*
Taking a coast wise steamer I stopped at Bahia the first capital of colonial Brazil. It stands on a hilly peninsula overlooking a lovely bay. If Rio were not so strikingly beautiful Bahia would be famous for its beauty.

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Smithsonian Institution

The falls are 2/3 again as high as Niagara with a vastly greater amount of water. It is not one straight fall but a series of tremendous plunges, and there is no place on earth where one can get a view of the entire falls. In a Geographic lecture this last fall I was delighted to see a photograph taken from the air.

The power plant is half way down the north wall. Iron stairs and ladders led down the face to it, and gave me a chance to collect the few grasses on ledges. One clump I got by climbing on to the little iron roof above a bend in the stairs. I took off my shoes to avoid danger of slipping and had to reach my very limit. As it happens it was worth the risk, for the species had only been collected once before. I found some other good things but nothing like what I'd expected. But if I hadn't gone I would always have felt I missed a great opportunity. The falls themselves were worth the visit, and I ~~stopped the car~~ on the return journey to collect. [11]

My next stop was at Bahia where I found all sorts of lovely things, tramping day after day and coming in with a heavy load. I was there for Christmas with a family of missionaries, then returned to Rio. The mountains about Rio are a botanists paradise, and kept me busy. There was a most interesting girl at the Botanical Garden, a Brazilian educated in England, who went with me a few times. Together we visited Itatiaia one of the two highest peaks I mentioned.

I had Christmas with missionary friends--- this is a view from their window—
Christmas in mid-summer surrounded by flowering trees and vines, and humming birds
and butterflies everywhere.

Returning to Rio de Janeiro in early January I made a trip to Itatiaia, one of
the ² highest peaks in Brazil, with a small party from the Botanic Garden. We went
by mule back to a rest hut just below timber line.

1968 lower slope of Itatiaia

1852. A view along the trail with a curtain of climbing bamboo.

[12]

1843. Itatiaia, from summit of Agulhas Negras, ascent

1837. Itatiaia alta, below base of Agulhas Negras. beautiful grasses

1838. Itatiaia below base of Agulhas Negras.

1844. Itatiaia, from summit of Agulhas Negras.

1845. Itatiaia, from summit of Agulhas Negras

1846. Itatiaia, from summit of Agulhas Negras.

The region is a government reserve like our national parks. We stayed over night at the station, reached by a steep climb on horseback. As we went up through the tropical forest next morning I was thrilled by seeing a troop of monkeys-- most graceful beautiful things. Great lacy masses of hanging bamboos bordered the trail and other lovely grasses clambered over the brush or peeked out below. We stopped at a mud hut rest house just below timber line and I collected a great pressful before dark. This was only about 6500 ft. altitude and midsummer, but it was bitterly cold during the night. With dry stockings, felt slippers and all my clothes, wrapped in a heavy blanket I lay and shivered and thought about the torrid zone of school geography. At dawn Dona Maria and I climbed the hill to see the sun rise over the mountains. About 7 we started up the mountain on horseback and were soon above timber line. The mountain slopes were gorgeous with red Amaryllis and tall pink and white flowers much like our daisy and masses of yellow, and best of all numberless grasses. We left the horses and with two men climbed the peak, exceedingly difficult but well worth the effort, both for the view and for the quantities of grasses I got. I made the return journey afcot, not reaching the hut till dark and with all I could possibly carry, and the next day again on foot, reaching the station after dark and working till midnight by candle light getting my plants in press. Oh but a bed felt good that night. Of course, it had rained most of the time, it always does in the high mountains. Next morning I walked to the railway and we took the train for Rio, happy and dirty, and weary. [13]

In February I went north into Minas, stopping at various places, finally getting into the campos where the high rolling hills are covered with all kinds of lovely grasses. I had a funny experience at one place. Of course, people were always curious as to what I was doing. I explained as best I could but it was simply incomprehensible. This time quite a crowd gathered, following me at a distance. When I sat down on the ground to put my plants in press and write notes they squatted in a ring about me--I felt like an animal in the zoo. I answered repeatedly that I was Dona Ignez, cientista Americana and so on but they only laughed. I started up hill and finally got away from them and was digging in peace when some one reached over my shoulder and jerked my knife away. It was a soldier and I was to come to the delgado, whatever that was. I told him where I was staying and that he was to take me there to let me get my passport. A second soldier came hurrying to join him and between them I returned to town. I hated to lose so much time, so I made them walk fast. As we climbed a steep road I walked at top speed just for meanness with those poor fellows gasping for breath. The delgado was the police station. The officer in charge said he had been told I had a big knife--the soldier had carried my digging knife. I showed him the edge dulled by digging. He grinned and gave it back to me and I went off again to the hills. As I hurried back that evening in the rain up the same steep road I'd led the soldiers, a boy ran out and offered me some bread. I thanked him but declined; he ran after repeating his offer. The next day I learned what it was all about. Word had been brought to the delgado that there was a crazy woman in the hills eating grass and she had a big knife.

[14]

The story was all over town and when the woman who kept the bakery saw me pass she sent her son out with bread for the hungry crazy woman. What a charming sequel. I couldn't imagine why they said I was eating grass until next day as I held a tuft of grass close to my eyes to examine its flowers with my lens I realized what they had interpreted so absurdly.

I found the Brazilians very kindly and friendly. A missionary advised me to use my given name (the Portuguese form of it) instead of surname; as Dona Ignez I was on friendly terms with them. The men were a nuisance sometimes. In Brazil woman's place is in the home and obedience is her part (mitigated by deception no doubt) about like England a century or more ago--I'm thinking of the plays of Sheridan and Goldsmith in which girls are expected to obey their fathers and marry his choice. One old man, in the interior of Bahia told me to go back to town, it was dangerous for me to be out alone. To get rid of him I started toward town then circled back out of sight I hoped. But he saw me and ordered me back, but I could walk faster than he could so he had to give it up. For a woman to disobey him must have been hard to bear! Farther back in Bahia where I stayed two nights the women discovered that I wore trousers. I make my tramp clothes of kahki, and drew trousers alike. The skirt is a nuisance but I attract enough attention as it is, If I wore knickers there as I do here I'd have the whole population after me. This night I held the naked baby in my lap and to warm her wrapped my skirt over her. In a flash of lightening those sharp-eyed women saw I wore trousers. The men were just inside the door. I motioned not to let the men hear, and they

[15]

nodded and thought it was a great joke. The next day when I got back all wet from scrambling around a waterfall all the women round about were there to see my garments on the line. I had torn my hand that day and got out iodine to put on it. What was it? Medicine for the cut. Dulcinea had a stomach ache and father had sore eyes, please give them some of this medicine. It is so hard to explain to people to whom medicine is magic, that one medicine won't do for all ills. There is no privacy in these houses. You are treated as one of the family literally. (There is no bedroom; my hammock was in the main room, with bags of castor beans.) They looked on as I got out clean clothes and one of them tried my comb and brush. I begged her to accept them as a gift. Just as I was leaving the other tried on my hat and I gave her that, returning to Bahia with a scarf wrapped round my head like a turban. Always they ask if you are married, how many children you have, how old you are. I had to answer that so often I spoke that much Portuguese fluently. *Eo são vieuva, não tem filhas.* [14]

To return to grasses. I had some glorious days in central Minas and then turned eastward to Viçosa in the matta. There is an agricultural college here, established by Dr. Rolfs for the State of Minas. With Dr. Rolfs and his daughter I went to Serra da Gramma. We climbed to the summit through rain forest, terribly hard going, and stayed over night on the open summit. About a week later Miss Rolfs and I went to Caparao to ascend Pico de Bandeira. It was an adventurous trip the guide we hired got lost and we camped out on the shoulder of the mountain in the rain. Next day we found the trail and reached a tiny hut with more holes than wall. I collected all afternoon in the cold drizzle and next morning we climbed the

summit but when the clouds lifted for a few minutes we saw a higher summit. We had climbed Pontao Crystal instead of Pico de Bandeira. But I made a fine collection. When I went to Brazil in 1929 I planned to ascend this peak from the eastern side. Miss Mexia of the University of California joined me for this trip through dripping rain forests, camping in the wet, and spending two days in the cold rain up on the grassland near the summit.

*the 5 years
series
from
Rio*

I got back to Rio with a tremendous harvest, made a trip out to the east end of the state of Rio, then struck into the interior stopping over a few days with the Rolfs at Viçosa. It is marvelous what that school is doing for the country. Ambassador Morgan speaking of the Rolfs said it was the most important work ever done by an American for Brazil. In highlands north and west I had glorious days, finding many grasses I'd never seen growing before. Once as I clambered up a rocky hill before me was a colony of a beautiful silvery Paspalum (my pet genus) so exactly like the drawing I had made in Munich of the original, from which it was described, that I recognized it at once. Such are the thrills that make one willing to endure all manner of insects, poor food and the rest. Near Diamantina, a city nearly 200 years old with stone-flagged roads, I explored the rugged mountains that used to be worked for diamonds and found grasses far more beautiful than diamonds. At the end of January I started for Matto Grosso, the "out west" of Brazil, making a few stops along the one railroad, then going south, 4 days journey by motor truck with a missionary moving to his station among the Indians near the Paraguay border. The truck stuck in the mud or needed fixing so often I had opportunity to collect. Returning to

[17]

the railroad I went on into the vast pontanal, low marsh, stretching a hundred miles east from Rio Paraguay. If you have read Roosevelt's Brazilian Wilderness you may remember what he says of insects. Mosquitoes, biting flies, midges like millions of red hot needles. From Porto Esperanza on Rio Paraguay I used the railroad as a causeway, going down into the marsh when I saw something I wanted, waist deep in water in places. The continual torment of insects drove me frantic, so to steady my nerves I took to singing at the top of my voice--it was less demoralizing than screaming and I had to have an outlet. As I clambered up the railway embankment with both hands above my head, full of tall grasses and singing "The strife is o'er, the battle done" any one who saw me might well think I was crazy.

2387 I went by steamer to Corumbá, another very old city, and crossed the border into Bolivia, having about two hours collecting there. The Bolivian mosquitoes welcomed me joyously.

Light I made another trip across Matto Grosso farther to the north starting, with a patched up car and its driver from Uberabinha on the railroad in western Minas. This trip was full of adventures--too full to tell about, but I returned with a fine harvest of grasses. On these trips across Matto Grosso I found quite a number of grasses not before known from Brazil, and some new to science.

For Biological Society, Oct. 24, 1925.

The collections of Martius and Spix as well as those of the other scientists who visited Brazil a little more than a hundred years ago have made that country the type locality for a great many species of tropical North America. Every botanist is familiar with Mart. after plant names, and every ornithologist, I surmise, with that of Spix after bird names. Ever since I have been studying the genus Paspalum I have longed to visit Brazil. A year ago I sailed for Rio de Janeiro and spent seven months collecting -- And now I am longing to go back, for Brazil is an immense country -- larger than the United States excluding Alaska. I visited only the highlands of the east.

Lights out

1964 We have all heard of the beauty of the harbor of Rio de Janeiro. As we neared the entrance to the bay I had the sensation of sailing into mountain tops on a flood. -- The few pictures of Rio are from photographs I bought, the rest are from my own photographs.

1964. Looking toward the bay from one of the high hills in the city.

1963. Pao de Assucar or Sugar Loaf. We reach the summit by means of a car hung on a cable. Sugar Loaf has been climbed several times on the more slanting side, and once on this side. Von Lutzelburg, the botanist, climbed up the crevice to the right, and went down on the other side.

1965. Corcovado, showing its precipitous face. From the sea the outline is very different. I had only half a day's botanizing on Corcovado this time but in January I spent several glorious days on it.

I took the first boat to Pernambuco (4 days after landing) in order to collect there before the dry season was far advanced. There were two saints' days, a Sunday, and a revolution in that time, so that I had a trying time

getting money changed, police permit to leave the city, and making arrangements--all on a very limited supply of Portuguese. The streets were crowded the evening of the revolution--but only a short time before I had seen this city the evening Washington won the baseball championship and the revolution seemed a tame affair.

1767. Pernambuco is ~~built~~ on land built up by coral reefs and mangroves. These are ^{mangrove} marshes to the north.

Most of the collections from Brazil are from near the coast. I wanted to get into the interior--the sertao, as it is called.

1761. This is typical caatinga--near Bello Jardim. The country was disappointing--devastated by overgrazing and seminomadic farming.

I made a second trip to the southwest, to Garanhuns, the end of the railroad. This was much more interesting.

I had heard ^{much} of the Paulo Affonso falls in Rio Sao Francisco, higher than Niagara and of much greater volume. No botanist had visited the region, so I was anxious to go. A road passable in the dry season had recently been cut from Garanhuns ^{to} to the falls. There is only one plow in the whole region I was told, but there was a garage with one or two trucks and one Ford car. I hired ^{the car} that and with two women missionaries crossed the 150 kilometers of sertao.

1775. Bom Conselho, with flamboyant tree, a typical Brazilian village.

1778. A zebu bullock-- the zebu are common, both pure and crossed.

1776. This shows typical sertao. About here we saw a tall flightless bird they call Cериema,-- a relative of the emu I think. It has the most astonishing call--like a boy yelling, but far louder than a boy can yell.

The last 25 or 30 kilometers we rode through the dark, the headlights showing gray brush and cactus. I waited breathlessly for the plunge into the tropical forest along the river. Finally we were halted by men with lanterns and we and our baggage were piled on a tiny trolley car and pushed by a man over a narrow trestle for about half a kilometer. We heard the war of the falls and in the dim starlight we saw wild plunging waters--no woods to obscure the view.

1789. In the morning this is what we saw. Early in the dry season the falls are 81 meters high (Niagara being 49 m.). In the rainy season in this region, June and July, and again in rainy season in Minas Geraes drained by Rio Sao Francisco (December to February) the river is much higher, sometimes 15 meters above its present level.

Paulo Affonso falls are so broken that they form a stupendous cascade, not a straight falls like Niagara. This is uppermost fall.

1793. This is lower and faces a great island which divides the falls. This is called Secret Island.

1792. This shows the top of the next fall.

1790. A twin falls, cutting across the island.

Climbing down the iron stairs and ladders to the turbine station we get other views .

1801.

1805. Shows how destitute the rocks are of vegetation.

1812. On the island is a single vertical zone of verdure.

1807. Adjoining it is scrub with cactus.

1803. all this spray going to waste instead of watering the canyon walls.

1809. the foaming river below the falls, showing the end of the island.

Here there is an enormous whirlpool. The river cuts far into the wall and then makes a sharp turn.

At the head of the recess is a cave about 150 meters deep.

1820. (mounted on its side)

Toward the back the floor is covered thick with bat manure. In front of it are piles of drift wood. I took some dried river scum from the rocks--like white felt. (Here to be examined).

From here we can see the little falls from the stream crossed by the trolley--1821, and climbing to the top of the cliff get this--1825--view of it.

1827. Following the cliff we can see the lower end of Secret Island and the river just before it forms the whirlpool, and farther along (1826) the Agua de Venta falls which separate Secret Island from the Bahia mainland.

1816-1814. The left wall seen at a distance from the turbine station.

1784. I went botanizing up river--this is what there was in the way of vegetation, but birds were abundant, doves, parrots, hawks, vultures and birds I didn't know.

*with bands on the
primaries*

There were so few grasses I collected everything--even some snails which I boiled out in my drinking cup, and sent to Miss Rathbun. They turned out to be a new species, *and were named* --- "chaseae."

1782. More of the desert. This is the trolley from the mainland to the turbine station--1781--a closer view. And this --1819--is Antonio who put up our hammocks, made coffee in the morning and served it with a cigarette in his mouth or behind his ear, and who led us over the rocks to the cave. He was the most peaceable person imaginable, but he always wore a knife-- (it went with the congaceiro hat) and when I said I wanted to ^{take} take his picture he posed with his gun.

1829. The city of Bahia is on a beautiful little hilly peninsula with palms everywhere. This is a view over the south end to the sea. I had fine collecting here and in sandy savannas and marshes to the north. A trip into the interior to Joazeiro and Serra de Espinhaco was disappointing on the whole, though I found some interesting grasses not found elsewhere.

I returned to Rio de Janeiro early in January. With Dona Maria Bandeira and through the kindness of Dr. Campos Porto of the Jardim Botânico I made a trip to Itatiaia, the highest point in Brazil. ²⁸⁻¹¹⁻¹⁹ From the railroad we went three days on horseback.

1968. The middle slopes are like this,--slender palms and tree ferns, and hanging masses of bamboos. Here we had a thrilling sight. Down the steep slope below the trail was a dark brown monkey up a palm tree so slender it swayed under his weight and a second running up the trunk. They looked at us and chattered. The second climbed down while the upper one

spread his little arms and sprang out, sailing down--it must have been 40 or 50 feet, into the top of another palm. A third and a fourth ran up the same palm, turned to look, and then jumped. I had never dreamed, from seeing them in a zoo, what beautiful and graceful creatures monkeys are.

1837. Alta da Serra, above timberline the rocky campo was full of grasses--1838--

1843. We left the horses here, near the base of the peak, Agulhas Negras, which means black needles.

1845. This is a view of the peak from the lower ridge opposite. These erect points are the needles.

1844. This shows the ascent. We climbed up these furrows on all fours, and made our way from one to another by hanging on to this low bamboo.

1851. This gives a better idea of these peculiar ridges and furrows. Above this we had to climb the needles, the way leading up a narrow crevice about as high as Washington monument, I estimated, under and over boulders wedged in the crevice. In places it seemed impossible, but somehow we managed to make it.

1847. Dr. Campos Porto wanted a picture of Dona Maria and me at the summit. The highest point was just about big enough for us to sit on. She was exultant over being at the top of her country and cried Viva, Brazil!

1846. A view from the summit.---In all directions were endless mountains.

I made the entire return journey to the railroad on foot, collecting, and Dona Maria and I returned to Rio with rich harvests--hers mosses, mine grasses and composite.

1872-- The open highlands of Minas Geraes is the best grass country I saw.

This shows the Serra do Curral, typical campo, to the south of Bello Horizonte, the capital.

1875. The land is terribly eroded in places. In slavery days ditches were used instead of fences. The ditches in the red clay hills have turned to vast arroyos. This one is near Lagoa Santa.

1888. Agriculture is more advanced in Minas than in the other states I visited, but this cornfield in a palm grove shows that even here they take the easiest way. The corn is not cultivated, and yet it was a fairly good looking field.

1891. Rio do Cipó-- Serra do Cipó, some 25 miles from Itambé and as near as I could get to it without outfitting an expensive excursion myself, was the very richest place I struck.

1898. This part of the serra is called Chapeo do Sol--the Portuguese for parasol. This is the new road being built from Bello Horizonte.

1905. This picturesque place is where I stayed.

1969. In Martius & Spix Reise we read of Villa Rica. This was the old capital of Minas Geraes in the days when it was an important source of gold. It is now called Ouro Preto. It is a picturesque old place built up and down the hills instead of only in the valleys between as are Rio de Janeiro and other cities.

~~de Janeiro and other cities.~~

I visited Vicosá where Dr. Rolfs is building up a school of agriculture for the state of Minas Geraes. With Dr. Rolfs and his daughter I visited Serra da Gramma known to hunters but not to botanists.

1974. This is a characteristic mountain slope east of Araponga. Araponga gets its name from the anvil bird whose note sounds like ^{an anvil.} that. I heard the bird but did not see it. *Araponga is blacksmith in Brazil*

We stayed at a fazenda two days' journey on horseback from Vicosá and the third day climbed the peak through bamboo jungle, the trail being cut as we went. It was terribly hard going and we reached the open summit only just before dark. We had been told there were pools of good water, but there was no time to look for them. We made camp in the dark without water--terribly hard on the Brazilians who needed their coffee. We had no tent but the men kept up a big fire and Miss Rolfs and I heated stones for our feet.

1972. In the morning Dr. Rolfs took this picture of us. This is Miss Rolfs--I am under the big hat.

Miss Rolfs and I, with a boy from the school farm, made a trip to Serra de Caparaó. The highest peak of this range, Pico de Bandeira, ^{the peak of Bandeira} disputes with Agulhas Negras the place for highest point in Brazil.

From the village of Caparaó we went on horseback with a hired guide and our José from the farm, expecting to spend the night at a rest house below the peak. Our guide, we found out, had never been half way there. We got lost, naturally, and camped before being overtaken by darkness

on a mountain side just about timberline where there were fallen trees from an old fire. The boys, especially the guide, were somewhat horrified at staying out in the mountains, and pleaded to go back to a herder's shack. The trail passed through a morass and along narrow ledges and it was none too easy riding in daylight so I rejoiced when Miss Rolfs decided that we would camp out. I made the fire (it had been drizzling all day) and I kept it going with the abundant wood dragged up by the boys. It rained most of the night, but we had a rubber poncho over us and the boys made a shelter of the large hides used on the pack mule. Next morning we reached the hut in the rain and stayed there all day (1975). I collected armloads of hay and brought them into the hut to put in press. We kept a fire going in the dirt fireplace and dried our things as much as possible. The next morning, leaving the guide at the hut we ascended the peak towering above us. Clouds were hanging over the mountains. When we reached the summit they lifted for a while and we saw a higher peak across the saddle. We learned later that we had climbed Pontão Crystal, 2798 meters, instead of Pico de Bandeira 86 meters higher. The botanizing was glorious, anyway, so I was not greatly disappointed.

1957. The last trip I had into the campos was to Campos do Jordão in the Serra de Mantiqueira in São Paulo. The hills are mostly open campos, the hollows between them filled with Araucaria woods.

Lights on:

Here is a vase of the Araucaria wood.

This is the Jacaranda, a tree of the Bignoniaceae.

This is an outfit for serving mate--which we call Paraguay tea.

These are the knives all the men of the interior carry at their belts. They look very wicked, but Brazilians are not quarrelsome. The knives are a part of their dress, like swords at court functions.

Outline for Dr. Munlicutt

Grasses for all America probably number about 4000. Brasil, at present known, about 1400. Much of Brasil not as yet explored for grasses. United States and north about 1350.

Great grasslands of the world:

North America:-- Plains and prairies from the plateau of Mexico to the Arctic prairies, meeting the tundra along the Arctic Ocean.

South America:--Llanos of Venezuela between the Orinoco and the coast ranges; llanos of eastern Colombia; composes of Brasil, north of the Amazon and from south of forested area of the Amazon to Rio Grande do Sul, continued through Uruguay to southern Argentina.

Europe:--Relatively small steppes of southern Russia.

Asia:--Siberia, south of the forested tundras, arid plains of Mongolia, Tibet and western China.

Africa:--The great savannas of east Africa with scattered flat-topped trees (made familiar to us by moving pictures of the Martin Johnson and others) the great game country from Uganda south, merging into the ~~savanna~~ veldt of South Africa, part of this very arid. Also the "sud" or fresh-water marsh bordering the upper Nile.

Australia:--The great arid steppes merging into desert occupying the greater part of central Australia. Probably the number of grasses is about of the entire world is about 10,000.

A great many species are very widely distributed, some circumpolar, like some of the blue grasses and fescues, which are found across northern Europe and North America, south into the north United States

and in the mountains farther south.

Many grasses, especially weedy ones, are found throughout the world-- for example, crabgrass. Some, many of them weeds, are distributed throughout the Tropics. For this reason it is difficult to estimate the number of different grasses in the world. Unlike as are Brasil and the United States, we have 108 species of grasses in common, including rice, maize, sorghums, and other cultivated grasses, but fully half are native (that is not introduced by man). Brasil and Africa have a large number of grasses in common. Capim gordura is an African species, early introduced in the slave trade, so was guinea grass (Capim guiné). Jaraguá is also an African grass, and Bermuda grass (Gramma de seda, or graminha) (these names given by Hoehne and Kuhlmann in 1941) came from the Mediterranean region, perhaps from Portugal itself.

Grasses have the widest distribution of any seed-bearing plants

See Hitchcock & Chase "Grass" page 243

The most important species of grasses:

1. Wheat, cultivated in western Asia and Egypt some 10,000 before Christ. See Grass pp. 204 for antiquity of wheat.
2. In America, maize or "corn" (maiz, milho grasso) [See Grass pp 213, 214; 216, paragraph 3. [For uses see p. 217.] Maiz was the principal food of the American Indians but was not known to the rest of the world until after the discovery of America. It was very soon introduced in Asia and Africa and today is important in South Africa, where it is called "mealies"--probably a corruption of "milho" of the Portuguese settlers in the Mozambique country. It is also grown in Australia,

but nowhere is it so important as in America from Canada to Argentina.

3. Rice, the principal food of the southern half of Asia, the East Indies, Philippines and other Pacific Islands, and an important food throughout the rest of the world, especially Brasil.

4. Barley; 5. rye; 6. oats, I should think would come next in importance food for man and beast.

7. Sugarcane, a grass, of which not the grain but the juice of the stalk is used. [see Grass p. 218]

8. Bamboos: So dependent are the people of tropical and subtropical Asia and the East Indies on bamboos that theirs has been termed a "bamboo culture". The young shoots of many bamboos are used for food. Bamboos set seed so rarely that their grain is not depended on for food, though at times when crops failed or were destroyed it has saved large populations from starvation. Bamboos supply almost all the necessities of life, except food, to many millions of people. Houses, bridges, rafts and furniture are built of bamboo. The great stems serve as waterpipes and cut in joints form vessels for water and all manner of containers. [see Grass p. 229]

The people of Sumatra and other Malays write with ~~the same material as~~
~~green stems of bamboo~~ a sharpened pencil of metal or bamboo on
the sections of ^{bamboo} green stems. When these are dry the writing shows
white against the green stem. Records, legends, and a vast literature are preserved in this way. Stems furnish fiber for cordage and paper. There are many kinds of bamboo. No one species can be said to be the most important.

The very large bamboo ("Bambu" in Hoehne & Kuhlmann) found along the roads in Minas Gerais and elsewhere was described in 1880 (as *Guadua pallescens*) as a native of Brasil. But Dr. McClure, the bamboo specialist, who studied bamboos for more than 20 years in China and adjoining regions, recognized it as the "punt bamboo" of southern China. It is used by the boat people to pole their boats. Its proper name is now known to be *Bambusa tuldoidea* described by Munro, in 1868 from Hongkong. When bamboo material could no longer be imported by U. S. from Japan and China, Dr. McClure was sent to explore the American tropics for bamboos suitable for fish-rods, ski-poles, and other purposes formerly served by imported bamboos. Dr. McClure sent back a large quantity of bamboo culms (stems) and they were tested for various purposes. *Bambusa tuldoidea* is one of the best. It is already cultivated in northern South America and in the West Indies. Several truly native species also proved to be excellent for commercial purposes.

9. Forage grasses!--Again no one species can be said to be the most important. In Brasil *capim gordura*, *jaraguá*, cultivated and growing wild, are probably of first importance. Of wild native pasture several species of *Paspalum* and of carpet grass furnish excellent forage. *Capim guiné*, and *capim elefante* (recently introduced from Africa) are also excellent forage. [You will have to augment this yourself for Brasil. For U. S. Kentucky bluegrass, redtop, timothy, bromegrasses]

10. Land building grasses--"Grass is what holds the earth together" said a sheep herder. Grass not only holds the earth together, preventing erosion, but vast areas are built up over thousands of years by grasses.

The vast pantanal along Rio Paraguay and its tributaries has been built up from fresh water marsh by *Paspalum fasciculatum*. [See Agriculture in the Americas July 1944, p. 123] The peat underlying the prairies and plains of the U. S. is (according to Dr. Dachnowski) composed almost wholly of the "common reed" (*Phragmites*) of North America and Eurasia. This indicates that as the land rose during the Miocene *Phragmites* took possession, and for a million years and more built up the land. It is still carrying on its work as may be seen in the New Jersey marshes crossed by the railways out of New York, and in vast marshes along the northern rivers and glacial lakes of North America. In South America it occupies only small areas, its place being taken by *Uba* and *Panicum rivulare* on river banks in Brasil. The low coastal areas of North and South America have been built up by species of cordgrass (*Spartina*) which endure salt or brackish water. [See Agric. in Americas July 1944, p. 123] A Brazilian species of cordgrass is still working in low places about Guanabara Bay (Rio de Janeiro), in tidal marshes of Bahia, near Santos, S. P., and on the great island of Marajo. It is also building up land in the Guianas.

Does not seem to be important in Brasil--I edited it

Sorghum--Cultivated from ancient ^{times} in Africa and to some extent in China, India, and other parts of Asia. The grain forms the principal bread-stuff of vast populations in tropical Africa. Some varieties furnish green forage for their cattle and the grain is also used for cattle feed. In the U. S. sorghum is an important forage crop and the grain is largely used for chicken feed. The juice of the stems of some varieties (the sweet sorghums) yield a delicious syrup or molasses, commonly made on the ^farms of the Middle West.

Is sorghum used in Brasil? There is a very tall species (*S. arundinaceum*) growing wild from Ceara and Pernambuco to eastern Est Rio de Janeiro, ^{so} São Paulo and Mato Grosso. There are no notes on its use by Brazilian collectors. "Capim maisanbara" is given as vernacular name on a specimen from Minas by Dr. Sampaio. "Milho de Angola" given by Hackel. Snowden (*Cult. Races of Sorghum* p. 235. 1936) says this is unsuitable for cultivation because the grain falls. I found it wild only. It is an annual to 2 meters tall.

The "great millet" of China (called kaoliang) is a sorghum. It is used principally to make wine and alcohol.

Botanical Expeditions to Matto Grosso, Brazil.

1788. Ferreira-- A. R. Ferreira, a Portuguese physician, went in 1788 from Pará up the Amazon and Madeira to the city of Matto Grosso (Villa Bella), returning the same way. His plants are at Lisbon, a set being also at Kew. (Trans. Linn. Soc. Bot. II. 4: 265. 1895.)

Manso ---. Dr. Patricio da Silva Manso. A Cuyabá physician sent plants from that place to Lhotsky in the early part of last century (Trans. Linn. Soc. Bot. II. 4: 266. 1895.)

1825. Langsdorff & Riedel-- A Russian expedition in charge of Langsdorff, the botanist being Riedel. Left St. Petersburg in 1820. Arrived in Brazil in 1821. After exploring in states to the east they arrived in June 1825 at Urubu Punga on the Parana, the southeastern boundary of Matto Grosso. They ascended the Pardo. ^{to the loc. Guaporé, Capim, Mamoré} A month was spent in the Camapuan Mts. where a large collection of plants was made. They then descended the Cochim and the Taguary, then up the San Lorenzo. In September 1827 they separated, Langsdorff going down the Arinos and Tapajos to the Amazon. Riedel descended the Guaporé, the Mamoré, and the Madeira to the Amazon. (Laségue, Mus. Bot. Deless. 478. 1845.)

1826-33. D'Orbigny-- Collected a few plants at Forte do

Principe de Beira on the Guaporé river (Trans. Linn. Soc. ^{Bot. II. 4: 1895} 266).

1830-33. Gaudichaud-- Said to have visited Matto Grosso on his second voyage (1830-33). (Rodrigues, Palm. Mattoogr.)

1844. Weddell-- Entered Matto Grosso from the east in 1844 going to Cuyabá, then north to the Arinos Valley and back, down the Cuyaba and Paraguay rivers to Olympe. He then turned back to Villa Maria, Matto Grosso City and on to Bolivia. (Trans. Linn. Soc. ^{Bot. II. 4: 1895} & 266).

1891. Moore-- Spencer Moore. Visited Brazil in 1891. He entered Matto Grosso by way of the Paraguay river reaching Cuyaba Aug. 13. Expeditions were made to places for 100 miles around. Plants described in Trans. Linn. Soc. II. 4: 265-516. 1895).

1892-94. Lindman and Malme-- The first Regnell Expedition. These two traveled in Brazil from July 1892 till Oct. 1894. They reached Matto Grosso in Nov. 1893. They remained at Cuyabá. Lindman returned in a few months; Malme the next year. Excursions were made to various places on the plateau. (Svensk. Akad. Handl. Bih. ³ 23 : No. 13.6. 1897).

1899. Meyer & Pilger-- Dr. Hermann Meyer & Robert Pilger visited Matto Grosso in 1899. They went first to Cuyabá, then to Rosario and on northeast to the Paranatinga and Batovy rivers. Meyer went down the Ronuro and Pilger returned to Cuyabá. Plants described by Pilger in Bot. Jahrb. Engler 30: 127-238. 1901.

1892. Otto Kuntze visited Matto Grosso in 1892, collecting in the region around Corumba, Cuyaba and Villa Maria.

1902-03. Malme-- Went on 2d Regnell Expedition in 1902-03 visiting Corumba, Guyaba and other points in central Matto Grosso. (See Arkiv Bot. 10: No. 17. 1911).

1908. Hoehne-- F. C. Hoehne, botanist, Sr. Ribeiro, zoologist, and Dr. Campos, geologist, set out from Montevideo in July 1908. They arrived at Corumba July 19 and went on to San Luis de Caceras. At both places excursions were made to near by points. They returned to Rio Janeiro Nov. 7. (Comm. Linhas Tel. Hist. Nat. Bot. 1910).

1911. Savage-Landor crossed Matto Grosso from Goyas to the Tapajos in 1911. Some plants are mentioned but probably no collections were made. (Across Unknown South America. 1913).

1913. Roosevelt-- The Roosevelt Expedition crossed Matto Grosso by way of the Paraguay, Guyaba and northwestward. **

Rodriguez, a Brazilian botanist, has visited Matto Grosso in recent years. He wrote Plantae Mattogrossenses 1898 and Palmae Mattogrossenses, 1898.

1913 * Hoehne (very young) went as botanist, ^{with Roosevelt} but after Roosevelt's accident (cutting his leg resulted in infection) Hoehne and another young Brazilian had to give up their horses to make a litter for T. R., and they made their way back afoot to a settlement. Told Alc. by ^(American) Brazilian woman missionary, former teacher of Hoehne, who told her. General Rondon, leader of the expedition, succeeded in bringing T. R. back to hospital and every care.

Map of Brazil showing routes of Martius, Wied, + others - Amaral in Bol. Mus. Nac. Rio de Janeiro 7: 187-210. 1931. 20

VICINITY OF CLE...

"Petropolis, crest of
Has very large droopi

DENDROCALMUS giganteus Munro (cult.)

Nastus brunneus Desv.
Brasil

?
=

new material
and cover paper

Seems a rough
Draft of article
in Smith Misc. Coll.

Vol. 78 : 47-54. (1926)

[which was edited
in final text.]

Edgar Alexander Means

(1856-1916)

A. C. ^{AC} heard Roosevelt's lecture in Washington,
on the "River of Doubt," explored on this visit
of Roosevelt.

AC crossed Matto Grosso, collected grasses
for about 2 hours ~~in~~ across the border into
Bolivia. In Matto Grosso to Curumba and south
(afoot of course); see A. C. Fitzfield books. Also from
Rio Grande south to near Paraguay

see field books

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No. 12
To modern see field notes

Chase, A.
1925
Nov. - 1924 - May 31
1925

quest for Grasses of Brazil.

By Agnes Chase

The flora of eastern Brazil is of especial interest to the student of tropical North American plants. Except for a limited amount of botanical exploration in Jamaica and in Santo Domingo before the revolution at the close of the eighteenth century, but few botanical collections were made in the tropics of North America until after an important scientific expedition to Brazil had made known much of the flora and fauna of eastern Brazil and part of the valley of the Amazon. Brazil, the West Indies, and Panama have many species of plants in common. In working on a family of plants of the North American tropics, therefore it is necessary to have a fairly detailed knowledge of the family as found in Brazil.

The Brazilian expedition referred to was sent by Francis I of Austria as an honorary escort to his daughter Leopoldina on her voyage to Brazil to marry the crown prince of Portugal and Brazil, the man later known as the "Liberator," Pedro I of Brazil. Pohl, Natterer, and Schott of Vienna, Raddi of Tuscany, and other botanists and zoologists accompanied the bride or followed, so that young Brazil for a time swarmed with naturalists. Most of ^{these} ~~the~~ naturalists remained in the vicinity of Rio de Janeiro or traveled short distances southward, but Martius and Spix, after a few months about Rio de Janeiro, went to Sao Paulo and from there made their way northward through Minas Geraes and Bahia to the city of Bahia. From there they went by boat to Ilheus and returned by land, and then went across Bahia, Piahy, and Maranhao to the north coast, crossing Rio Sao Francisco at Joazeiro. Then they traveled

up the Amazon to some distance beyond Teffe (or Ega).

The Amazon and other parts of Brazil have since been explored by Germans, Swedes, Swiss, English, Brazilians, and in recent years by Americans, and the U. S. National Herbarium has, by exchange, come in for a share of the plants collected, but there was no U. S. National Herbarium at the time of Martius and but little has since been collected, at least of grasses, in the region he traversed in the interior; wherefore the grasses of that region are known to us only (or chiefly) from the specimens preserved in the herbaria at Brussels, Munich, and Vienna.

Itinerary in Brazil.

Arriving in Rio de Janeiro late on Saturday November 1, I spent Sunday afternoon botanizing on Corcovado, where I seemed to be following Raddi's footsteps, so many of his species, described from the mountain did I find. In spite of the dense population in the lowlands the mountains about Rio de Janeiro have not been spoiled for the botanist. Except for the invasion in places of *Melinis minutiflora* called *Capim gordura* (molasses grass by us) an African species early introduced into Brazil, the steep jungly slopes I imagine are not greatly changed from what they were a hundred years ago.

Four days after my arrival I left for Pernambuco in order to reach that region before the dry season was much advanced. (Ships from the United States do not stop at any Brazilian port north of Rio de Janeiro.)

Pernambuco, or Recife as the city is commonly called, lies on flat ground built up by coral reefs and mangroves (both Rhizophora and Avicinnia). Extensive mangrove marshes surround the city and Rio Capiberibe flows slowly through it. The city is cut into by tidal lagoons into which the mangroves are advancing. The surrounding region is densely populated. Wooded hills which at a distance showed no signs of being inhabited turned out to be full of huts and goats and children. In little clearings were patches of maize and beans, and a few banana trees and sometimes oranges. Vetiveria was planted about many of the huts. This is one of the oil grasses, introduced from the ~~West~~ ^{East} Indies. In the West Indies, the roots are used to scent clothing and to keep moths away, but here it is used to thatch huts. The caju is everywhere, a beautiful wide spreading tree bearing multitudes of fragrant small maroon flowers, buzzing with bees, and fruit in all stages of development. These trees are a blessing to a blistering botanist.

The wet meadows and stream borders offered the best botanizing. Here were great Paspalums and Panicums higher than my head, tangled with aroids, ferns, and brush. I was surprised to find a bog that quaked even more than do Maine bogs. This was about half a mile long and billowed under my feet in a way that made me gasp, but it yielded some little known grasses.

I wanted to see something of the sertao, the interior arid region.

I had letters to missionaries in Recife and from them I secured much helpful information. Here and elsewhere I found the missionaries to be the best sources of information. ~~An American consul might not be able to tell one where the railway station was, but the missionaries~~ ^{They} who travel everywhere and, like the botanists, do it on a limited amount of money, ^{and can} could direct one anywhere and give information about baggage and the numerous details that are so troublesome to a stranger unprepared for them.

Bello Jardim, 186 kilometers to the west in the Serra da Genipapo, at an altitude of 600 to 650 meters, was chosen as representative of the sertao. The hills are covered with scrub or low trees, the "caatinga," consisting of *Mimosas*, *Acacias*, and thorny shrubs and semi-arborescent cactus, except where it has been cleared for planting. Ground is cleared by burning and cotton, sugar cane, castor plants, mandioca or tobacco are planted, sometimes here and there among the shrubs or tussocks of sedge that refused to burn down. There seemed to be little or no cultivation. There are no plows or other agricultural implements, planting and cutting ^{being} are done with heavy hoes and large knives. When a field becomes overgrown with weeds or brush it is abandoned and a new place is burned. Land, I was told is very cheap. The result is that cultivated spots are scattered hit or miss through the scrub ^{which} and the scrub is overgrazed by cattle, horses, donkeys, sheep and goats till only inedible shrubs and herbs, *Jatropha*, *Capparis* and the like, flourish.

No forage crops are grown in the sertao except for little patches of Para grass here and there along a stream. In November the dry season had only begun yet every edible plant in the sertao seemed to have been consumed, and there were some eight months to endure before the rains.

A second journey was made to Geranhuns, 850 meters high in the sertao, 271 kilometers to the southwest at the end of the railroad. The country here is much less barren, and more progressive, with fairly good sugar cane fields and bullock carts in common use.

With two women missionaries I visited Paulo Affonso falls in Rio Sao Francisco, about 150 miles from Geranhuns. These falls are 610 feet in height, higher than Niagara and of greater volume. The region had not before been visited by a botanist and much was expected of it, but the desert extends to the vast river, even the canyon walls being almost devoid of vegetation. As elsewhere, when grasses were scarce other plants were collected.

One day, while waiting for the boat to Bahia, was spent botanizing about Maceio, Alagoas. I reached Bahia December 7th and spent nearly a month botanizing on the peninsula, in the sandy savannas and marshes to the north and in the hill country across the bay, about Cachoeiro and Feira Santa Anna. A trip across the state to Joazeiro on ^{Rio} the Sao Francisco was disappointing, the country being devastated by long continued over-grazing. A stop at Itumerim in the Serra da Espinhaco, to the south of

Joazeiro, secured a good harvest.

I reached Rio de Janeiro a second time January 9, midsummer. People were complaining of the oppressive hot spell. It struck me as just about like pleasant summer weather in Washington. Several days were spent on Corcovado, Pão de Assucar and the other hills of the coast range, then with a party from the Jardim Botânico of Rio de Janeiro I visited Itatiaia, one of the two disputed highest points in Brazil. From the railroad the party traveled on horseback, with pack animals. A night was spent going and returning at the Florestal, a station where the Jardim Botânico is carrying on work, on Mont Serrat, affording opportunity for collecting in this typically tropical forest country. From Mont Serrat to the summit of the mountain and for some miles beyond on the Minas Geraes side the country is a Federal reserve under the charge of the Jardim Botânico. One day was spent making the ascent from Mont Serrat to a rest house, about 2,100 meters altitude a short distance below timber line. The third day the party ascended the Agulhas Negras ("Black Needles"), the culminating point of Itatiaia^a. This was long known as the highest point in Brazil and was said to be 2,994 meters altitude. Recent measurements, however, give a lower altitude, about 2,830 meters. From the summit I made the three days' return journey on foot, collecting the grasses. The high campos above timber line were covered with grasses, large and small. The trail borders and mountain slopes also yielded a rich harvest.

The State of Minas Geraes, nearly as large as Texas, was the main objective, and from the end of the rainy season in early February to the end of fall in May was spent in this region. The flora is very different from that of the regions earlier visited. The high hills are covered to a large extent with open or brushy campos. From about Bello Horizonte north and east this campos type was seen at its best and was the richest grass country anywhere seen. Agriculture in Minas is far in advance of that in Pernambuco and Bahai. There are good roads in some parts far in the interior, and one sees clean cultivation and good-looking animals.

A few days were spent at Lagoa Santa, where Pedro Lund, the Danish ethnologist and botanist lived, and where the inclosed ground he purchased for a burial place now forms an interesting little preserve of the original campo. From here I went by motor truck to Vaccaria in the Serra de Cipó, and spent four days in the high grassy campos.

A day each was spent in the mountains about Ouro Preto (formerly called Villa Rica) and Itacolumi. Then, April 10, I left the Zona de Campos and went to Vicosia in the Zona de Matto to the east. Here Dr. P. H. Rolfs, formerly director of the experiment station at Gainesville, Fla., is establishing a school of agriculture for the State of Minas Geraes. Of special interest were the fine plantations of forage grasses and tropical fruits and also a row of thrifty little chaulmoogra trees. There is much leprosy in Brazil, hence the importance of these trees.

With Doctor Rolfs and his daughter, I visited Serra da Gramma, and with Miss Rolfs Serra do Caparaó, high mountains in the eastern part of the State. Pico da Bandeira, the culminating point of Serra do Caparaó, is now said to be the highest point in Brazil, 2,884 meters. Owing to bad weather and a guide who did not know the way, we climbed Pontao do Crystal, 2,798 meters high, instead of Pico da Bandeira. A large collection of interesting grasses was obtained.

A last trip in campo country was made to Campos do Jordao, Sao Paulo, a region of high grassy hills divided by ravines full of *Araucaria brasiliensis*. A few days were spent in the Serra do Mar about Rio de Janeiro and then, May 31, I sailed for New York.

1. Mangrove marshes north of Recife. The coast of Pernambuco is built up by coral reefs and mangroves. In the distance is seen the ruins of an old fort and lighthouse.
2. Part of Paulo Affonso Falls. These falls are so broken they form a stupendous cascade. There is no one point from which the entire falls can be seen. The canyon walls are devoid of vegetation except in a few spots watered by the spray.
3. The garden at the Florestal on Monte Serrat. The trees are *Araucaria brasiliensis*.
4. View from the summit of Agulhas Negras. This high region, Alta de Serra, is rich in grasses.
5. A cornfield in a palm grove, foothills of Serra de Cipó. Land is commonly cleared by burning. Trees that withstand fire are allowed to stand.
6. Ouro Preto, formerly called Villa Rica, the old capital of Minas Geraes in the days when there were important gold workings in the vicinity.
7. A lawn of *Stenotaphrum secundatum* at Dr. Rolfs' home, Vicosia. Americans in Brazil are always striving for lawns. *Stenotaphrum* is coarse and produces stout runners difficult to cut. This is the only lawnmower I saw in Brazil.
8. A colony of *Panicum rivulare* along Rio Casca, Serra da Gramma.
9. Characteristic bamboo-covered slope in Serra da Gramma.
10. Dr. Rolfs, Mrs. Chase and outfit in the foothills of Serra da Gramma.